PSYCHOLOGY
OF
EDUCATION

LECTURES ON PSYCHOLOGY

FOR

TEACHERS

BY

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NOTE.

These lectures have been printed from the notes of a stenographer who was present when they were delivered. In order to preserve the effect of the spoken word, they have not been rewritten. They were delivered to beginners in the art of teaching and have been printed to help them. If the lectures receive the attention of other readers, the limitations of such a course of talks should be taken into consideration.

A. B. M.

New Haven, Conn.,
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PSYCHOLOGY AND ART OF TEACHING

Mental Images Or Ideas	Repetition of Images or Movements			Higher Operations Choice and Association According to Relation of Likeness
Knowledge Getting	Memory	Habit	Reflex Action	
Contact with Things Pictures Oral Instruction Books etc.	Ideas of Places Events History etc.	Care of Body Conduct Reading Habit Use of Ref. Books etc.	Talking Reading Writing Ciphering Spelling Maps etc.	Classification Explanation Generalization Reason etc.

PSYCHOLOGY	Reflex Action Habit	Intelligence Feeling	
SCHOOL WORK	Maximum—Practice Minimum Knowledge	Maximum	Interest and Knowledge
		Minimum	Practice
COURSE OF STUDY	Beginnings of Reading Writing Spelling Ciphering Talking— Use of words Pronunciation, etc. Reading Music	Reading— Things Books Fiction Science Biography Poetry History Geography Science History Study Citizenship	Pictures Music Etc.

INTRODUCTION.

The Teacher's Need of Psychology.

It is not necessary to take up much time in defining psychology at the beginning of this course of lectures. I will merely try to suggest at the outset what the lectures are about. The general ideas on this subject needed by the teacher are very few. The mistake in the past has been that the teachers have dealt with too much psychology. Because a great deal of it cannot be used in school work. So in the first place let me say that I have very few ideas on psychology to give instruction upon.

These ideas, though they are few, are certainly important. A teacher has charge of forty or fifty children. All of these individuals have physical organs we call brains. If she is to teach them anything she must deal with their brains. The human brain is a machine; therefore does it not seem reasonable that she should know something about this machine? What should we think of a person who is to take charge of a steam engine who did not know anything about the machine?

The president of a railroad once asked me, "What is the use of all this psychology?" It was the typical question of a practical man, so I tried to meet him on his own ground and

ventured to reply, If you were to engage a man to have charge of one of your locomotives, you would deem it essential for him to understand the operations of the machine. So it is not unreasonable to maintain that those in charge of human minds should know something about their operations. This body of knowledge of mental operations is psychology. But he continued, "Have not teachers taught in the past without this knowledge of psychology?" "Yes," I replied, "Just as truly as your locomotives in the past were successfully run by burning wood, but by gaining more knowledge you have changed your method and now use coal for the sake of efficiency and economy.

As you will see from the outline I have placed on the blackboard, there are three phases of the work of teaching, namely, instruction, repetition or drill, and testing or recitations. Hearing a recitation is only one part of teaching. In many schools the teachers fail to do the more important parts of teaching, namely the instruction and drill parts. Now some truths of psychology are needed in order to realize when a teacher ought to instruct, and when she ought to drill. Some teachers are wasting time because they do not know this. I venture to say that when we go out into the schools and find a good teacher, she is often

good because she is an expert in drill. Sometimes we need to give instruction and sometimes we need to drill. It depends upon the subject we are teaching. Psychology will make plain to you when you must drill and when you must instruct.

Now let me give you an illustration to make plain what I mean when I say that sometimes we should have a minimum amount of knowledge and a maximum amount of drill, and sometimes a maximum amount of knowledge and a minimum amount of drill. Take for example riding a bicycle. How much knowledge does it require? It is practice that it is needed here. In three minutes a person can tell all that is required to know how to ride a bicycle. The man who, when asked if he could play a violin said that he did not know, he had never tried, suggested this truth. The knowledge part of playing the violin is not very great; it is necessary to repeat,—repetition is the important feature.

Another example may make this clear. In the past there has been a great waste in teaching language. Because it was thought that people could learn the art of language by the knowledge of the science of language. What is the principle by which I say a-b-c-d? Why do I say c after b, d after c? Is it knowledge

that directs me? Not at all. It is simply the result of practice,—not the result of knowledge. So in learning any language the truth that we must recognize is that in order to acquire the language we must recognize a certain truth in psychology,—we must emphasize the repetition and not the knowledge. The reason why a teacher in the primary department succeeds in teaching a child to read is because she realizes the value of drill,—she realizes this simple truth of the human mind. We study the Latin language seven or eight years. Can we speak it? or can we read it? Children study the English language in the primary grade and learn to read it in a year or two. How do they learn it? By following out this truth in psychology. The art of teaching must conform to such truths. I give these illustrations now simply to bring out this one thing, that some knowledge of psychology may be helpful to a teacher in determining her work.

A teacher should know something about the operations of the mind if she is to care for its education in an economical way. Therefore our purpose will be to consider some simple truths concerning the minds of children. The mental processes that a teacher in the common schools is concerned with are mainly two—

knowledge getting and memory. We shall attempt in this course to analyze these processes. We shall be led to consider habit and reflex action and to point out how closely related they are to memory. Attention will be dealt with not as a process but as a condition of mind action necessary for economical education. We shall consider briefly the higher intellectual operations, such as reason, abstraction, etc., although the teacher of the common school is not much concerned with these processes.

What does psychology say about knowledge getting? It says that after the human brain has had a certain impression under the influence of the surroundings, and has been affected by it, the mind gets a mental image, and then without that environment the human brain can repeat that action.

Repetition is a condition of one of the great laws of the universe. We see this in changes of all animal life from the sea anemone, and the jelly fish to the higher forms of life.

When I talk about this power of the human brain to do over again what it has done before I am talking about what people call memory or habit or reflex action.

If you should ask me what I saw in the northwestern part of Connecticut yesterday I

should have to repeat some of the impressions I received. I should repeat the images which I formed yesterday. This is memory. When a person does something while he is talking, like taking hold of a button, you say it is habit. Habit in one respect is the same as memory, a repetition of what has been done before, only it is more persistent.

You teachers of gymnastics* are training boys and girls to walk in a certain way. It must become unconscious walking to be graceful. It is so in dancing; just so far as there is any thinking it is awkward and ungraceful. In this the person must pass from memory to habit. This is the power of brain material to repeat its action.

I shall assume as the unit of knowledge, the mental image for the sake of definiteness in our line of thought. This name has proved helpful in common experience although it may not satisfy the ultimate analysis of metaphysics.

Expounders of psychology seem to differ mainly in their nomenclature and each is justified to the extent to which he is helpful and clear. Therefore I shall take the liberty of selecting my starting point. The mental image can be recognized as a definite part of the

*Teachers from the New Haven Normal School of Gymnastics were part of the audience. This explains repeated references to gymnastics.

mental experience of every one. There are other ideas of an abstract nature which of course cannot be thought of as images. But they must be derived from something, as "to abstract" means to take away. Therefore our unit will serve as the source of other ideas of our mental content. All language in its history has been so associated with material things that it is difficult to divest words of their connotation when applying them to immaterial thoughts.

I shall also use the terms that are associated with brain action largely because in this way, I think I can be more definite.

In studying the mind we study the brain because mind action is accompanied by brain action. If a person in dealing with brain, implies that mind action and brain action are the same because they accompany each other he is misleading. The difference between mind action and brain action is so great that we cannot comprehend it.* I am going to consider the part the human mind plays, therefore the part the human nervous system takes in these operations of mind.

*"Can we think of the subjective and objective activities as the same? Can the oscillation of a molecule be represented in consciousness side by side with a (psychic) shock and the two he recognized as one? No effort enables us to assimilate them. That a unit of feeling has nothing

in common with a unit of motion becomes more than ever manifest when we bring the two into juxtaposition."—*Spencer*.

"But supposing we get so far as to be able to prove that the irritation of a particular fragment of cerebral substance gives rise to a particular state of consciousness, the reason for the connection between the molecular disturbance and the psychical phenomenon appears to be out of reach not only of our means of investigation but even of our powers of conception."—*Huxley*.

In order that a teacher may instruct economically she must realize what the parts of knowledge are. In days gone by we used to depend too much on books. What was the danger in this? It was not that the child learned the contents of the book word for word. The children used to learn the words instead of the ideas. The teacher did not realize the significance of knowing what the nature and sources of knowledge are.

In considering any mental image, as that of an orange, for example, we shall find that it is made up of color, form, surface and other parts which are sensations derived from the source in the environment. This must be the mode of the teacher's analysis of knowledge getting, in order that she may understand the conditions of profitable instruction. I shall try to show you how the mind gets all its sensations which being put together produce ideas.

Therefore the two phases of the subject to be considered are the human brain and its environment. In order to understand the environment in this connection we must think of it as made up especially of light, sound and resisting matter. We must think of light and sound as modes of motion capable of affecting the brain, thus producing light and sound sensations.

We must also think of the brain as capable of acting in response to its environment. A clear idea of action is necessary in order that we may not be misled by the common expressions in regard to the mind. We often hear such expressions as "Put ideas into the head," "Cram the mind with knowledge," as if the brain were merely a receiving agent. An illustration with a piano forte may bring out this meaning. We could not understand such an expression as "putting tunes into the piano." We know that the only way to get effects from that instrument is to produce action in it. The performer as part of the environment, strikes the keys, and thus makes the wires inside of the instrument act. So the only way in which brain results can be effected is by making the brain act. So we shall have occasion to use this idea of action in studying the relation of the human brain to its environment.

II.

KNOWLEDGE GETTING.

At the last lecture reference was made to the two general functions of the human brain. When there are things present in the environment the brain responds to them, and it also can repeat its actions, even when the things that at first were concerned in producing those actions are not present in the environment. We call that first act getting knowledge; we commonly call that second act remembering, or memory. Let me caution you about this. I am taking a very simple view of this subject. Do not infer that I mean to imply that these are the only functions of the human brain or the human mind. They are only two very important functions.

Knowledge getting is the process we shall deal with this morning. Let us take up a common kind of knowledge, and see if it is not composed of images, and then let us see if the images are not composed of sensations. I say common kind of knowledge because there are other varieties of knowledge in connection with which, as I said at the last lecture, it is not quite so apparent that the image is the unit, but I may say that knowledge depends upon the image. In order

to realize that this is true let us take for an illustration any individual when he is a child. Think of his knowledge. Suppose we could begin with the knowledge getting of an infant. It is very difficult for us to tell where to begin. I remember a quotation that has been used in this connection:

"Who can tell what a baby thinks,
Who can follow the gossamer links
By which the manikin feels its way
Out from the shores of the great unknown
Into the light of day?
What does he think of his mother's eyes?
What does he think of his mother's hair?
What of the cradle top that flies
Backward and forward through the air?"

This expresses the difficulty in analyzing a child's mind. Certainly thinking here refers to having ideas,—it refers to knowledge getting. The baby certainly gets images of his mother's eyes, of her hair, and of the cradle top. His first knowledge is gained in that way. He has images of the furniture, the chair, the table, and when he looks out of the window his knowledge is made up of images of trees, dogs, horses, and men.

Now the child gets beyond his immediate environment. He may go to a large city when he gets older. He gets more knowledge. He

sees large buildings, he sees more people and more things. Now I am giving these facts to make plain to you that as you follow the growth of an individual's mind you will see that it consists in getting these images that are furnished by his surroundings. We must study knowledge in this way.

Let us see how a child's knowledge is extended still further. Now he reads. What does he derive from reading? He gets an experience with images. He reads the story of Little Red Riding Hood. He has revived in his mind an image of the girl, Little Red Riding Hood, an image of the woods, of the wolf, of the grandmother's house. He sees a series of mental pictures. His knowledge consists, you see, in his experience of forming mental pictures. These are his ideas. Before I go on I want to call your attention to one feature of knowledge getting by reading. We do not get any new parts of images. The printed page arouses images that have been formed before, putting them together in a certain way. If a child has never seen a wolf, or a picture of a wolf, his idea of a wolf is very indefinite. We have to tell him a wolf is like a dog.

The book is simply a compilation of ink marks. You look at those ink marks and if you have associated with them ideas of some kind

that you have gained from actual experience with the sources of ideas, then that book means something to you. The child sees the combination that makes up the Red Riding Hood story, he sees things, that he has seen before, put together in a new sequence. The moment we use some word with which the child has had no sensory experience then his knowledge is blank at that place.

I will say something to you about writers so as to make this aspect plain. When we read the books that Dickens wrote we know what Dickens knew. Dickens has pictured for us scenes that he has had experience with,—scenes in the streets and alleys of London, in the Court of Chancery, in the old curiousity shop, and the mail coach that went in and out of London. Where did Dickens get these pictures? Not from any inner consciousness let me tell you. He got them from living in London, and having experience with all the different phases of London life.

Dickens himself said, "My imagination would never have served me as it has, but for the habit of commonplace, humble, patient, daily, toiling, drudging attention."

Scott wrote of Scottish scenery, the highlands of Scotland, especially the lake scenery. What was Scott's preparation? It was image

getting. Scott was constantly in the midst of these scenes, and was impressed with the woods, the lakes, and the shrubbery of Scotland. When he went to the ruins of an old abbey he would take notes to help him revive impressions he had received. Scott's genius consisted in grouping these impressions—he was a genius in his combinations.

You have never seen any picture of which you have not seen the parts before. The parts are all reproductions of some things that you have seen, but the originality consists in putting them together. Take Raphael and Michael Angelo. Their paintings are wonderful in composition, and sometimes difficult to understand, but the parts are all familiar to us. The point is this, that imagery is the important part of common knowledge, and that this kind of knowledge is the kind that is utilized on every hand by the individual as he is adjusted to his environment, and by the writer when he revives the environment by writing books. You see what a prominent part in knowledge getting this phase implies. So when a teacher is concerned with knowledge this is what she must deal with.

Now the process of knowledge getting includes two parts as I have already suggested. It includes the thing outside the individual

and the nerve parts, or the nerve machinery.

To illustrate what I mean by these two phases let us take the image of a flower,—of a rose. Now in order that a person may get an idea of a rose there must be the thing in the environment, then there must be the nerve machinery. My image of the rose will be largely a visual image, rather than a sound image or a taste image. It will be largely made up of the sensation of sight. Let us see what the rose, the thing in the environment, has to do with knowledge getting. Light strikes the surface of this rose and is reflected. It then strikes the eye which is the end of the optic nerve, and nerve impulses pass to the brain center where the mental image is formed. We must have light and the rose must reflect the light or we cannot have the mental image. The teacher must realize that the source of a visual image must at first be a thing in the environment. She must not think that because she is dealing with a book that she has the essential source of knowledge. Then the thing for the teacher to do is to be sure to provide for the thing in the environment. Our mental image of the rose is mainly made up of the effects of this reflected light. It is also includes an odor, but you realize how faint the odor part of the rose is. I shall speak of this at another time.

As I have said, a large part of our ideas is made up of the visual. It is necessary to study this in order to realize why it is so. I am going to take up the nerve machinery concerned with the visual part of the image. First there is the eye, and second there is the nerve connection, a collection of nerve fibers like white threads, that pass to the interior of the head and terminate in what we call the brain center. These are the parts we must take into consideration in order to realize how ideas are formed. The eye has a subsidiary part in the actual process of forming visual images, it is simply an instrument. We do not see merely with our eyes. The eye is one of the means of seeing, but people can see without the eye,—they can see when the eyes are closed. So the eye is only an accessory in this process of image making.

I am going to take up the brain center and show what it has to do with image making, especially with the visual image. The center of the brain is that which is immediately concerned with the visual image. The eye and the nerve passing from the eye up to the upper part of the head simply help in this process. I want you to think of the eye-ball as a helper rather than as an agent immediately concerned with image making. Now in order to make

that plain to you I will take up one or two illustrations.

Let us take the matter of dreams. A dream is a sequence or collection of mental images. The person is asleep, his eyes are closed, he is in the dark, yet he sees persons, he sees things. He has plenty of mental images. How can this be possible unless the nerve centers can act over again as they have done before.

Let us take for another illustration the effect of drugs. A person will take a certain kind of a drug into his stomach. The blood takes material from it up to the brain, where it is brought into contact with the nerve centers and there is a series of sights. De Quincy put himself under the influence of opium and afterwards wrote those sketches, "The Confessions of an Opium-Eater." The substance stirs up the nerve centers, and produces the accompanying mental act.

This is true also of disease. Take a person afflicted with fever. The blood in this diseased states goes up to the brain, and the nerve centers are influenced, and made to act, not by anything before the eyes, but by this diseased and inflamed condition of the tissues. The person just as truly sees things as if the sources were before his eye.

Some years ago I had the interesting experi-

ence of addressing the inmates of an Insane Asylum. There were six hundred people with unsound minds before me. They could not control their minds because their brains were affected. Their minds were affected because mind action accompanies brain action. Some of them were constantly laughing. I asked the man in charge what I had said to make them laugh. He said they were laughing at their hallucinations, not at what I was saying. One woman said "Jane, will you keep still?" There was no "Jane" near her, but she was addressing a "Jane" that existed in her mind. The next morning I looked out of the window and there I saw a man who was delivering a speech in a very dignified way. "Who is that?" I asked. "Oh that is a man who goes out there and speaks every morning," was the reply.

The parts of that man's brain concerned with visual images acted, and he just as truly saw people as if they really were there. So hallucination is a very decided instance of this image forming. We have all had experience with this. We have all had the hallucination of hearing. This matter of seeing stars is not always a delusion. If you strike the head the concussion may stir up the nervous machinery, and by that concussion the brain will be affected, and visual flashes will be produced.

When we have images formed we have a phase of the imagination. We formerly used the word "imagination" as applied to fancy, to something unusual, but today we find that all processes of image making are processes of the imagination. Some men have it in a more pronounced way than others. Morphy used to play seven or eight games of chess blindfolded. Since then men have played as many as twenty games. Their testimony was that they could see the chess-board, and the chessmen just as plainly as if the board was before their eyes. Another man after seeing one of Rubens's great paintings went home and reproduced it, so that it was almost impossible to distinguish the copy from the original. Mozart when he was fourteen years old heard the "Miserere of Allegri" at the Sistine Chapel. His father, going into his room one night, found that he had written the score of the music. He did that by his wonderful power of musical imagination.

I want to make plain to you how important these sensations of the human brain are; therefore we shall have to take up these processes of image forming a little more in detail.

III.

NERVE MACHINERY.

We will proceed now to study the eyeball as part of the machinery concerned in forming visual images. The eyeball increases the effect of light upon the nerve. That is its special part. Therefore you see that it is not so intimately connected with the mental product, that we call the visual part, as the nerve center that I tried to talk about at the last lecture. The part that the eyeball performs is similar to that of your eye-glasses, or of a microscope. Your eye-glasses are additional eyes put beyond the end of the optic nerve for the purpose of increasing the effect of light, that is, for the purpose of making that part of the environment more effective on the nervous machinery. The microscope is an additional eye placed beyond the optic nerve, just as the eyeball is placed at the end of the optic nerve, for the purpose of making light from certain objects of the environment more effective in the work of the eye accompanying visual images. This comes into my mind now, and I cannot refrain from mentioning it. Have you ever observed that when you touch the hairs that are at the end of a cat's nose she will shake her head? Have you noticed how sensitive the cat is when

you do this? The cat's whiskers may be regarded as levers extending from the nerves. They may be called intensifiers of the effects of the environment. The eyeball may be regarded in the same sense as additional machinery for the purpose of intensifying the effect of the environment. It does this by bringing the rays of light together, and by limiting the effects of the different rays of light. Let me explain to you these two ways.

In the first place how does the eyeball increase the effect of light by bringing the rays of light together? I will call your attention to certain parts of the eyeball that we must take into consideration in this connection. I shall not give you names because I want you to concentrate your attention on the parts, and on their functions. I shall not attempt, in my analysis of the eye, to mention all of its parts. I am concerned with the parts that will help us in their relation to the mental product.

The eye is a spheroidal box that may be compared to a camera. Secondly, there are certain media, that is, certain transparent parts through which the light can go. When I say transparent I mean that they will allow the light to pass through very freely. The third part of the eye is the end of the nerve connection, the end of the optic nerve. The optic

nerve enters this spheroidal box at the back part. Observe again how much this is like the camera. You put into the camera a film and some chemicals that are responsive to light. I want to call your attention to the lens, this double, convex lens, that is situated in the front part of the eye. By the diagram you recognize that I have represented the object a b, from which rays of light are passing, either emanating as from the candle flame, or reflected as in the case of other objects. The rays of light that are reflected from this object fall upon the double convex lens, which has the power of bringing these rays of light together. Thus all the rays of light that leave a are brought together again at c. Now this is the way the lens affects rays of light.

Don't you see that the eyeball is an instrument for making hundreds of rays of light fall on a particular spot of the optic nerve, and in that way the eye serves to make the light more effective in stimulating the optic nerve than if only one ray of light reached that spot. So in in this sense by bringing rays of light together it is an intensifyer of the light effects of things in the environment. It seems to me that the diagram ought to bring this out.

I want to call your attention now to the end of the nerve. I have said the nerve is made up

of thousands of small fibers packed together side by side, like the fibers of a string. These fibers are spread out and form a network inside of the eyeball. These fibers are furnished with terminations that are like little rods and cones. They are shaped like rods and cones, and are therefore so-called. So think of the ends of the nerve as being terminated by these minute forms. The light strikes the ends of these rods and cones. It has been estimated that the rods are about 1-350 of an inch in length, and about 1-1400 of an inch in thickness. The cones are a little shorter and a little thicker. They are not quite so numerous. Now what do they signify as parts of this machinery with reference to this mental process of seeing? If each of these rods is a separate termination, and involves a separate part of the mental image don't you see how minutely definite is the provision for the imagery? Don't you see how small the part of the environment may be,—how small may be a wave of light to produce on the brain an effect different from that of its neighboring part? Therefore don't you see how definite the results of seeing may be?

Now in order to bring this out let me compare some parts of the visual image with other sensations, for example the sensation of taste. Try to see if you can recall tastes. See if you

can recall the taste of almond and the taste of vanilla, and realize where the one begins, and the other leaves off. Suppose you take two different substances into the mouth. In the process of eating it passes to the place where the nerve machinery concerned with taste image is located. Are the places of separation very definite? Can you distinguish definitely the taste of the one and the taste of the other? Now take the case of the eye. Try to recall an image of a collection of colors. Don't you realize how definitely you can separate one color from another? Take a group of figures upon a carpet or upon a wall paper and recall how definite is your revival of the image of each contribution of color. The analysis of the machinery makes plain to us that so far as we have the nervous machinery elaborated and perfected the psychical results will be elaborated and definite.

The teacher must know what parts of ideas are clear and in what respect they effectively contribute to the intelligence of the human mind. As we study the human being more, we realize that it has been practice of the individual that has resulted in the development of this part of the human body that we call the eye. The individual's optic nerve in the process of evolution has constantly been bom-

barded by waves of light in this experience we call seeing. He has not had so much experience in tasting and smelling, and this may be the reason why these senses are not so highly developed. We find that the smelling sense of the dog forms a very large part of his intelligence, because the dog has always responded to his environment in this way.

I will now take up the subject of the tactual parts. I have said that while the visual part of the image is important it is not the only part, and I will proceed now to take up another part which is almost as important as the visual, though it does not seem so to us, as the visual is so much more vivid and definite.

If we refer again to the rose we used as an illustration we find that our image of it is made up largely of the visual, and very faintly of the odor part, but how conspicuously of the surface of the petals, the way they bend or yield to pressure, the hardness of the stem, and the general shape of the flower. All of these features enter into our idea of a rose, and when we say we know a rose our image of it includes all of these as well as the visual portion. Therefore our image of the rose is a composite made up of different parts produced by the environment acting upon the different parts of the nerve machinery.

The tactual parts are the effects from contact and muscular action. When we use the word "touch" to designate this part of sense experience there is danger of inferring that we mean mere contact. We mean not only this effect, but also that of muscular action.

Muscles are made of this protoplasm that has the wonderful power of contractility, this inscrutable power of lengthening and shortening. When we refer to muscular action we refer to that special form of change that we call muscular movement. Now this is attended by tactual sensation. So when we refer to the tactual parts we refer to the effects both of mere contact and of movements of the body. The nerve machinery concerned with the tactual parts are those nerves that come down to the outside of the body, and the centers from which they come. I will not deal with the centers now, but will speak of these fibers that come down and whose ends are imbedded in the skin and the muscles. So that when the skin comes in contact with something of the environment we may have a part of the mental image which we call the tactual.

Those parts of our ideas that are concerned with size, form, surface, consistency, are the parts of our ideas gained through this tactual machinery. Pressure, distance, motion, and

temperature are all the results of contact of the environment with the tactual nerves. Let me give you an illustration of this. What do I mean when I say that this wood is hard? Why simply that cohesion holds it together, and I have the feeling of resistance when I touch this part of the environment with my hand. If I put my hand into water I do not have the experience of resistance, because the parts are not held together as the parts of the wood were.

I am trying to emphasize again that in all this process of knowledge getting we have to take into consideration the effect of the environment upon the nerve machinery. I want to call attention to the fact that the person must think of the environment not only in terms of light, but also in terms of resistance. Don't you see how important it is therefore that science work should be a part of our educational system in order that we may be able to study even the truths of psychology.

The visual parts are so vivid that they overshadow the tactual parts, and it has only been by careful experiment and observation in science that the students of mind have been enlightened on this point.

I refer to one instance that you have probably read about. It is given in almost all text-

books of psychology. Cheselden, an English surgeon, operated upon a boy twelve or fourteen years old, who was afflicted with a cataract and had come to the surgeon for relief. Cheselden operated so that the light could pass through, and the boy regained his sight. The testimony of the boy was that he could not determine shape. He could not tell the difference between a square and a cube. He had difficulty in telling the difference between a cat and a dog. At one time he is said to have passed his hand over the cat's back, and to have said, "I shall know you after this, puss." He had to get the experience of visual effects, through the tactual effects that he had had all his life. We do not realize how much of these light and shade effects we have gained by the environment coming in contact with the skin, or by moving through surrounding objects.

We find that the tactual experience has played a very important part in the process of image getting. It is interesting to know that the whole animal creation began its response to its environment in this way, so I think we are justified in saying that the tactual sense is the primitive sense, and a fundamental means of intelligence.

IV.

NERVE MACHINERY.

As in the case of the visual sensations so in the tactual sensations the action of the brain center is of special importance in that it is immediately concerned in the realization of these senses, that is, we do not feel with the ends of the fingers in the sense that the feeling is located in the ends of the fingers. The feeling is dependent upon the immediate action of the brain center. I brought this out by illustrations in the case of the visual. In common experience this is not so apparent with the tactual sensation, but a number of illustrations show that the feeling is dependent primarily upon the action of the center in the brain.

I will give one illustration. In the case of amputation this truth is brought out. If a person's arm is amputated at the elbow it is commonly observed that the person imagines that he has pain in the ends of his fingers when he really has no fingers. It is the repeated testimony of surgeons and patients that they locate the feeling in the part of the limb that has been removed. You see the sensation cannot be located in the part of the body that has been entirely removed, therefore it must be located in the brain centers. Surgeons explain this by

referring to the anatomy of the nerve fibers. The nerves terminating in the elbow have repeatedly transmitted nervous impulses from the ends of the fingers to the brain, so now they transmit impulses as if from the fingers, and the mind centers refer these sensations to the source from which they have habitually come. So if there are no fingers, and the brain centers locate the feeling in the fingers, it must be the work of the brain centers, and not the work of any nerves in the fingers. People say that for some time after they have lost part of a limb they have a feeling of pressure on the remaining part of the limb. This emphasizes the fact then that the nerve center is the important part of the machinery in the case of this sensation as in others.

The tactual machinery varies also in its power of discrimination as well as the visual machinery. I will not attempt to analyze this, I will merely allude to it. Experiments have been made showing that different parts of the skin being terminations of the nerves, have different powers of responding to the stimuli. A pair of dividers may be used to illustrate this. The ends of the dividers can be separated as far as two inches and applied to the back before two stimuli are realized. They can be separated a little more than an inch on the

back of the hand to distinguish between two stimuli. On the fingers they may be separated 8-100 of an inch, and on the tongue only 4-100 of an inch. In different parts of the exterior of the body to which the tactual nerves come we have different powers of responding to the stimuli. I will not dwell upon this now, but I simply say that this is very suggestive of the efficacy of practice in developing the different parts of the skin. Thus the tongue has been constantly touching parts of the mouth, and we have gained a great deal of knowledge of the interior of the mouth from this constant tactual experience. The individual has also been constantly using his fingers in responding to his environment.

Now I want to call attention to the association of the visual parts and the tactual parts in making up the images that we use in common knowledge. Those illustrations that I gave, notably the one that I designated as Cheselden's boy, brought out this fact. The reason that Cheselden's boy had difficulty was because he had not associated his tactual experience with the visual experience. I want to emphasize this idea of association. We begin with it here. We shall find that this idea of association is a very profitable one in interpreting mental actions. We shall have occa-

sion to use it on every hand. We encounter it here in our efforts to determine how our ideas are made up.

Association.

We find that the tactual experience and the visual experience all through existence have been constantly practiced together. I call your attention to one aspect of this. We say we determine distance by means of light, but we use the sensation of sight, that we get from light, as a sign of what we have gained from the tactual. We have so practiced the visual and tactual experiences together that when we have a certain visual experience it serves as a symbol to arouse the tactual experience that we have gained by actual contact with the environment. We use certain sensations as signs of others, and these signs help to revive other sensations.

Touch and Education.

Now we will consider the educational value of that part of knowledge that we get through the tactual machinery. At the last lecture I commenced to speak of the fact that the lower animals are largely dependent upon the tactual sense. By lower animals I refer not to such as the cat and dog, but to the sea-anemone, the jelly-fish, the sea-urchins, and to the clam and

oyster with which you are familiar. These animals are very simple in their structure, and they have not the apparatus with which to respond to light and sound, although some of these, the anatomist thinks, have a rudimentary structure that seems to be responsive to light. The sea-anemone will wave its tentacles in the water until some foreign substance touches it, when it contracts. This is responding to the environment through the tactual. So we find that it is a primitive or fundamental sense in this respect. If we believe in evolution, has not the human race had much experience with the tactual or touch sense? In the process of getting visual images the rays of light fall on a particular part of the optic nerve and stimulate it by touching it. When air vibrates in a certain way the vibrating matter touches the end of the auditory nerve. Here we have contact even in the case of sound. So these phases of sensation are different ways of touching the nervous system.

Mr. Herbert Spencer calls attention to the fact that the lower animals depend largely for their intelligence upon contact with the environment. If you have ever offered an elephant a peanut you have noticed that he depends largely upon his trunk in his investigation. The point that Mr. Spencer makes is

that he has gained much of his intelligence through this tactual sensation. If you will recall your observations of the parrot you will remember that the parrot investigates his environment largely through touch. He uses his beak, he uses his tongue—he is the only bird that has a tongue—he uses his claws in feeling around. He is about the only bird that grasps his food with his claws and brings it up to his mouth. Here is a bird that is very intelligent, and he depends largely upon the tactual for his knowledge.

Animals that have feet with separate toes are generally more intelligent than animals with only one toe. Mr. Spencer calls attention to the fact that an animal with five toes can deal with more than one part of an object at once. So we see that animals use the organs of touch very extensively. The cat's common way of finding out things is to put out her paw and touch the things. Even in the case of the horse that has only one toe the tendency is to find out things through the tactual sense. If you go near him, and he wants to investigate you, he uses his lips. In this way he tries to get acquainted with things outside of himself.

What is the educational value of this sense? As we review the experiences of childhood we see that the child is constantly reaching out

toward his environment by means of his hands. He begins to get a knowledge of things in this way. A child will reach out for a light a number of feet away, as though he thought it was near. Therefore a knowledge of the distant light, or that the light is distant, depends upon his having had tactual experience with it. A child cannot always hold his hand out in a straight line. He has to have considerable experience to know how it feels to do this. A child in the primary school learns to put a mark where he sees he ought to put it, but he must first have a tactual experience to know how it feels to do this.

The principal part of the knowledge in gymnastic exercises is gained through the tactual sense. A person may get a visual image of how a club is swung, but it is not until he knows how it feels to swing a club that he knows how to do it.

Right through childhood we have to depend upon the knowledge gained by this tactual experience in order to get certain results. If a child is to learn what a pound weight is his knowledge must be gained by the feeling of resistance he has when he holds it in his hand. So the teacher must be sure to realize how much depends upon the tactual experience, and she must not expect the individual's knowledge

to be complete and accurate without this experience.

We have a number of experiences in adult life that depend upon the tactual sense. The workman gains his knowledge largely through this sense. He takes a chisel and he determines whether he uses the tool right by the feeling he has. When he uses the chisel he determines whether he is taking off a large or small shaving by the way it feels to do it. Men know what they are doing with tools by virtue of this sense of touch, whether we are thinking of a carpenter's tools, of a machinist's tools, or of a sewing needle. In the use of all such tools we have to depend upon the resistance of matter to get some of our knowledge.

I once heard of a woman whose sensory nerves in her arms were paralyzed and useless. She used to hold her baby with her arm, but in order to know she was holding the baby, she had to look down and see.

When we think of musical instruments we realize that the performer depends largely upon the feeling resulting from the motion of his hands. The performer on the piano forte depends upon the feeling to know whether or not he is striking the right keys. How true this is also of the violinist, and of all players upon stringed instruments. They have to depend

upon the sense of touch mainly to know if they are doing that which is right, for their eyes are directed toward the score. One of the most remarkable examples was the case of blind Tom, a colored man, who used to play the most difficult pieces on the piano forte.

Take the case of Helen Keller, one of the most remarkable exhibitions of the accomplishments of the intellect in responding to the environment through the sense of touch. She cannot see, she is deaf, she has only the tactual sense, and yet you have only to read her biography to know how intelligent she is, and how she can interpret her surroundings.

Imagination.

We will now consider the imagination. It has commonly been thought that the imagination is a faculty of the mind. The common impression has been that if we wish to recall anything we call into service the agent, memory, and if we wish to picture something particularly fanciful we employ that hand maid of the mind, the imagination.

The modern psychologists says that the mind is not possessed of different faculties as though they were all different parts belonging to the mind just as we regard the hands, arms, and legs as belonging to the body.

The imagination then, as I shall say of memory and reason, should be regarded as a process. We ought to think of it in this way. It is a process of forming images.

Let us take two instances, and I will ask you if it is reasonable to call one instance a case of the imagination, and refuse to say the same about the other. I will first refer to an adventure that I myself once had. I will merely suggest a few incidents of an all night trip in a small sailboat. I sailed out from a Maine harbor through the ship channel and out on the ocean. My course was such that I can recall the small lighthouse on the end of a stone breakwater that I passed. On the other side was an old octagonal fort with its granite walls. Beyond was an island with its green slopes and rocky shore and the white spray of the waves breaking on the ledges. I can now see the blue water of the ocean extending far out to the horizon; the shore with its coves and beaches and the cottages high above the dashing waves. These images are sufficient for the purpose of my illustration.

Now let us refer to our experience in reading any part of Defoe's Robinson Crusoe, as for example the description of the shipwreck. We see Crusoe swimming from the wreck, struggling to reach the shore, his impressions of the

island and his first sleep in a tree, his awakening in the morning and his sight of the wreck on the rocks, then his return to the ship and rescuing the many things that he needed.

Now why should we call one mental process imagination and refuse to recognize the other as the same kind of a process? Were not both the same kind of mental operation, that of forming images? One may have been true, and the other may not have been true, but the processes were essentially the same.

The man who writes words, and makes us revive images in this way, is original in the sense that his combinations are new. You have heard a great deal about the "creative power" of the human mind in works of the imagination, in stories, and in poetry. This creative power consists simply in putting things together.

This brings us to idealism. The idealist in art is a person who selects the best parts that he has gained from things in the environment, and produces a combination that is new in that those parts have never been together in that way before. The sense in which we use the word "ideal" to praise anything, or express that it is of high order, depends upon the selection on the part of the artist.

You remember a woman once said when she saw Turner's great painting of a wonderful,

gorgeous sunset, "Whoever saw such a sunset?" But Turner said, "Madam, wouldn't you like to see such a sunset?"

So in Victor Hugo's "Story of Jean Valjean" you might ask, "Whoever saw a human being like the bishop?" But Victor Hugo would say, "Wouldn't you like to see such a human being? " He selected the best parts of various human characteristics, and putting them together produced an ideal character,—one that we would like to see.

The Greek artists excelled in sculpture. As a result of their training the Greeks were well developed, and the artist constantly saw their partially exposed bodies, and taking the parts of various human forms, and putting them together, he produced perfect human forms by his combination.

V.

OTHER PARTS OF KNOWLEDGE.

I shall not go any further in the process of analyzing mental images. We have proceeded far enough to realize that the units of knowledge may be designated as images, that these images may be thought of as compounds of sensations, so far as we can think of a psychical process as a compound. I have tried to point this out by considering two of the important sensations that enter into images. I might deal with sound, and emphasize the fact that there are sound images as truly as there are visual, and that sound as a sensation is sometimes associated with other sensations. I might point out to you that the sensations of tasting and smelling enter, to a certain extent, into ideas, but it would be interesting to note that their part is a very faint part, and that their faintness seems to be proportionate to the use that the human individual, at least, makes of these sensations in his intellectual operations. He does not practice these two senses so much in his intelligence as he does the others; therefore according to the law of practice, the law of the survival of the fittest, they seem to

some extent to be dropped out of the process of knowledge getting.

I hope that I have said enough about this knowledge process to make plain to you that in all of our educational work we must be sure to have these images. If we provide for the getting of this concrete part of knowledge, whatever other parts there are, will be derived from it. Of course we have other kinds of ideas as I suggested at a former lecture. We have ideas that are derived from these images or from parts of them, that we call abstract ideas. These ideas are abstracted or taken from mental images. We have ideas of relation besides ideas of things. We have ideas that may be designated as general ideas, we have ideas of action, of things changing and acting, and so on.

But this is what I want to emphasize, that if we have vivid images of things, all these other kinds of ideas can certainly be derived from them, and the production of these other kinds of ideas will certainly depend upon the realization of the concrete idea.

Thinking.

So we may proceed, then, to the next note which I have placed on the blackboard, in which I throw out this suggestion, that clear images are essential to clear thinking. Now

you may ask what I mean by thinking? We have not analyzed thinking under this term yet. Some phychologists exalt thinking into a faculty, as if there were, as I said about the imagination, an entity, a something, whose peculiar function is to think. It seems to me a very vague way to analyze thinking in these terms. Thinking involves a succession. A succession of what? Why a succession of these images or ideas that I have been talking about. When people are thinking they have a train of ideas. Now of course there are many different kinds of thinking, but let us be sure to keep in mind that form of thought expressed by the word succession. In order that the succession may be clear the terms must be clear. Just think how people who have much thinking to do depend upon that. The lawyer in trying a case first secures his facts or ideas of evidence. Then he proceeds to put these facts into certain sequences so that he will get other facts, ideas, judgments, or convictions, call them anything you please.

Take the work of a doctor. He goes to his patient, and the first and most important thing he does is to get his ideas, his images. He does it by this process that I have been emphasizing, —by using his environment, by observing the patient, by examination, by diagnosis. He does

it by using his senses. I might go on and consider a business man. His wisdom, what is called business sense, has been largely the result of the process of dealing with facts that he has gained from experience with things in his environment, by his long experience with life. I might take up any activity in life that results in what we call intelligence, and point out that the important factor is this unit that we call the image, and the important process is the sensory process.

Those who emphasize as a purpose in education, the function of "learning to think" as they express it, seem to fail to apprehend what thinking really is. They seem to imply that thinking is a special intellectual operation. There is no reason for differentiating this process from the unceasing mental sequences of wakeful existence; from the "stream of consciousness" as it has been expressed. Isn't it better to emphasize the importance of acquiring profitable knowledge to think about? The trouble is, the individual does not reflect upon what those, who complain, want him to think about. Education should be concerned with the best knowledge. This necessitates comparing educational values and determining what knowledge is of the most worth for modern life. If thoughts are aroused that ap-

peal to one as worth while he will reflect upon them. The apparent worthlessness of much in prescribed education is what influences the learner to prefer to think about other things. Those who maintain that there is too little thinking, would better consider the importance of presenting in a convincing way something that undeniably pertains to the welfare of the individual and society, and he will stimulate thinking on the part of the learner. Let a person be persuaded that a subject is of real worth and he will think about it. I shall speak of this again in connection with attention.

Therefore the teacher must realize that she has to deal with intelligence. We may exalt the teacher's work by saying she must teach the child to think, but he must have something worth thinking about. We may say the teacher's work is to build character, but there must be something upon which to build character. Whenever a writer has attempted to arouse the emotions he has done so by means of producing images.

I cannot refrain from emphasizing another point of view in this conection. You have heard it said that we don't teach rules now. Take the case of arithmetic. We teach rules now as much as we ever did. How does a teacher teach a rule today? Take the process of addi-

tion, or the process of multiplication, or any other process of ciphering. She goes to the blackboard and performs the operation. She shows how she does it just as she would if she were going to teach any other art. She shows the way, and the way is the rule. We are teaching the rule just as truly as we ever did, but we appeal to the senses instead of giving written words to study. We exhibit the action just as we would exhibit the action in any other art,—we are observing this economical way of getting knowledge. It is by varying the mode of teaching the rule that the common school of today is distinguished. It is doing its work in a more economical way than formerly. When the child sees the instructor act, whatever the art may be, whether it is ciphering or gymnastics, the child gets a mental image, and the teacher must realize that she must produce a vivid image on the part of the learner. In the work of the gymnasium the first thing you have to consider is the instruction. This instruction consists in doing something by which the pupils will get a clear idea of what is to be done. Repetition is a very important phase of the work, but we must first have a very clear idea of that which we wish to repeat. The coach of an athletic team brings that out. He has learned to instruct very carefully. If

you go out on the field you will see that he does not merely tell but he shows how a thing is to be done.

Now I said that thinking involves sucession. I mean by succession putting ideas after one another. If we take the commonest kind of thinking, that of a child, we shall see that his thinking consists in having his ideas follow one another, logically, as, for example, the child learns that fire is hot. This consists in his first having an idea of fire, and then an idea of the fire burning him. He learns that a dog bites by getting an idea of the dog, and the action of the dog biting. So even in higher forms of thought the essential thing is a succession of ideas.

Law of Intelligence.

This leads me to the law of intelligence, which helps us to realize what we mean when we say that these ideas in thinking succeed one another according to a certain order. The order of succession is referred to in this law. This law also helps us to realize what we mean by good thinking, ordinary thinking, or poor thinking. *We have it expressed in this formula, the coherence or association of images with one another, corresponds to, or depends upon the persistence of the association of the parts in the environment. Some of our associations,

*Spencer

then, are fortuitous, because our ideas correspond to things that happen to be together by chance; some are properly associated in succession or thought, because they correspond to a certain uniform order of things in the environment; some necessarily cohere, because of the unvarying association of the things in the environment that produce those ideas. This is founded upon that great principle we learn from evolution. The way of expressing this law, according to evolution, is that the inner adjustment of ideas is proportionate to the relation between things or events in the environment. Now I am going to give you one or two illustrations to bring out the importance of this law. I will not attempt here to define education, as such definitions are generally inadequate, but I will venture to state that the best education prepares one to respond to the best in his surroundings, for his own welfare and the welfare of society.

Let us take some of the necessary associations of ideas. When I say necessary I mean an association that no individual can help making. Now let me give you this illustration. You have a mental image of a whole thing, then you have a mental image of a part, now you have an idea that the whole is greater than the part. Can you have any other succession of

these ideas? You can not help having those ideas in that succession. I am referring to ideas, not words. It is very easy to make a sentence, and say a part is greater than a whole. This is what teachers allow children to do very commonly,—repeat words without taking pains to have ideas go with the words.

I take the following illustration from mathematics, because the necessary forms of thought are used in mathematics so generally. Things equal to the same thing are equal to each other. We cannot put ideas of that succession together in any other way. We can think of this, that every effect has a cause. Can we think in any other way? This is what I mean when I say necessary sequences. Now as to the application of this law of thinking, it implies this, that the thinking being has responded to things in his environment that have ever been related in a certain way. He has never been in relation to a part greater than a whole, but his incessant practice has been with a whole greater than a part. Therefore the persistency of his thinking is proportionate to the persistent association of these sources of his ideas. Take the experience of a common individual. The nature of his intelligence will depend upon the persistency of the parts of the environment as they have been associated.

The child has been related to the fire. and he learns that fire burns. Why? Because his experience has been concerned with this sequence. He learns that a dog bites in the same way.

Take the idea of the rose. The reason why we associated the visual with the tactual sensations was because they have always been associated. Why do we associate leaves with the tree? Because these two parts have been so associated in our experience. So the persistency of thought depends upon the persistency of the association of things in the environment. All through the history of the human race as well as of the human individual this has been the law of knowledge.

We recognize this in education, and we try to produce a true association by putting things together according to their true relations. All of our science work is for this purpose. I said that the difference between good thinking and poor thinking is expressed by the way in which ideas are associated. When a person says, "I saw the moon over my left shoulder, I shall have bad luck," he is indulging in poor thinking, because there is no relation between seeing the moon over the left shoulder, and having bad luck. Primitive man used to think in this

way. When, at the time of an eclipse, the Indians were made to think that darkness was caused by their bad treatment of the white men, that was wrong thinking.

Now in science we use apparatus, we make experiments, in order to make plain certain sequences, and to make ideas follow one another just as events follow one another. Take the case of chemistry. If we take one colorless gas, oxygen, and another colorless gas, hydrogen, and put them together and apply heat, a change takes places, and from the chemical union of these two gases, we get water. We have a great many such experiments to make it easy to put ideas together in their true sequence. So education in chemistry consists in having events follow one another, and in having ideas follow in a corresponding way.

There is no study more effective in developing true thinking than science. The person has to think truly because his ideas follow one another in the actual sequence of events.

The difference between reading history and studying history is that in studying history we try to select the changes that follow one another according to a certain sequence. We realize that if we have certain events in the actions of men, certain other events follow.

Whenever we have a sequence of thought that seems to be contrary to our experience we are inclined to doubt. We may tell a person that if we have two men with a distance between them of one hundred miles, and that if the first man speaks the second man can hear him, the person may say that is ridiculous. Why? Simply because this may be contrary to his experience. But if we bring him to the telephone he has to think that way. We may take a cylindrical machine and speak to it. We try it after a while, and it will talk back. The person may say he does not believe this, because his ideas have never corresponded to such events. His thinking this will depend upon his having this event take place in his own experience.

I have come now to the second part of the action of the brain, namely, repetition. I have said that the brain, and therefore the mind, is capable of acting when the environment is present, and capable of repeating its action without the environment.

Now there are different kinds of action. There is reflex or automatic action, then memory, habit and instinct. They are essentially the same process in that they involve repeated action. They differ in that some of them are more persistent tendencies to act over

again. I am going to analyze these different kinds of action. I will first take up reflex action, as this is a prototype of all the others. If we get an idea of reflex action it will be a guide to help us know what we mean when we say that habit, memory, and instinct are different phases of repetition.

I shall begin with reflex action next time.

VI.

REFLEX ACTION.

We come now to the second general part of the subject that I announced at the outset of these lectures, repetition of activity on the part of the mind, and on the part of the nervous machinery. Repetition of what? Repetition either of movement or of ideas. The mind can repeat these processes that we have been concerned in analyzing under the general subject of knowledge getting. If the mind could not repeat, how helpless would be our subsequent condition. We assume in all educational processes, that the being we are concerned with can do over again what we are giving instruction upon. In that light we realize how important is this whole subject of repetition. I will try to make this more obvious as I proceed with the analysis.

I would like to have you think of this process of repetition in the different aspects I have suggested in the note on the blackboard. The different phases are designated by different names. We have what we call reflex action, or automatic action, we have what we sometimes give the name habit, sometimes memory, sometimes instinct.

Now don't misunderstand me in this. I do not mean to imply that they are in all respects the same. Memory differs in many respects from what we call habit. This is what I want to point out and enforce, that the essential part in each one of these processes is the same, namely the power to revive an act.

I think we may begin to study the part that I have called reflex, or automatic action, and we shall have this essential feature brought out in a very simple way, so that we can refer to it constantly in considering other aspects of this process. Therefore I propose to take up very briefly this subject of reflex action.

Now the repetition of an activity may result from a stimulus that is without, or from a stimulus that is within the being. In most cases of simple reflex action the stimulus is without. In order to make plain to you what I mean when I say automatic action I want to show you an illustration this morning which will involve a stimulus from without, and you will observe that the action that we get is a repeated action, it is a repetition on the occasion of an external stimulus.

For this purpose I have here a frog. This frog has no brain. I have put on the board a diagram. The spinal cord comes up as far as I have put this line. This part is what we

ordinarily call the brain. It represents that part corresponding to the human brain. If we were to take out the human brain it would represent what has been done to this frog. Yet this frog is breathing, its heart is beating, it is living, in the truest sense of the word, just as much as it was six weeks ago before the brain was taken out. It has been living six or seven weeks without any brain, showing that in some of the commonest cases of repetition, it is not necessary to have the brain that is concerned with some of the higher nervous processes. Now I am going to put the frog on this inclined board. It may jump, for when you touch it, it does what any other frog would do. The frog is now a machine repeating the movements it has done before, so it illustrates to you that without that organ that is ordinarily associated with mind processes, such as choice and will, processes that approach anything we call consciousness, without that part of the brain machinery here is an animal that can repeat many of its activities when stimulated externally. If you were near, you could see it breathing, and of course its heart is beating, otherwise it could not live. You see it can balance itself on this inclined board. It can kick and use its legs just as well as any frog. By putting my hand on the frog I irritate and

stimulate it. Just as soon as it is touched it tries to do what any frog does, yet it has no cerebrum. It is just as much without a brain as if it had no head. The only advantage in keeping the head on is to feed it, for it would not take any food if we did not put it into its mouth.

I put the frog into water, and you see it can swim very well. When I touch the frog's skin, or when the water bathes the outside of its skin, it repeats those muscular acts with the same regularity as if it had its whole brain. This is the machine movement that we call reflex action, because there is no will action, there is no choice of action, and no direction from a higher phase of consciousness, whatever consciousness the frog may have. Therefore you see these movements are just as truly associated in a machine-like or automatic way, as the raising of a weight would be if you should pull the string running over a pulley at the other end of which a weight had been attached.

Of course if a frog has anything like consciousness it must be that it has the same part of the nervous machinery necessary for consciousness that you and I have. This frog has not that part of the machinery. It has not, therefore, in its experience anything like con-

scious willing, conscious choice, or conscious sensation.

Now as to the meaning of automatic action which this illustration suggests, let me refer to the human individual. Many of our acts are just as truly automatic, that is, just as truly devoid of anything like consciousness, or will, on our part as the action of this frog without any brain. The beating of the heart, the breathing process, the swallowing process, sneezing, coughing, are all processes belonging to this group of reviving processes that I call automatic. If a person is asleep and another person pricks his hand with a pin how quickly the sleeping person will draw his hand away. When he awakes he will testify that he was totally unconscious of doing that. How many times we have heard of people who have got out of bed, dressed themselves, opened doors, gone down stairs, and walked around, then they have come back, undressed, and have gone back to bed again. When they awake in the morning they have no realization of what they have done. Some people have done difficult things while part of their brain was as quiescent as if they had no brain. These are all sequences of movements done in a machine-like way that we call automatic. Many of our activities are of that character. I will not go

any further in this part of the course to describe any more of these experiences of the human being because they will come up under another phase of repetition that we call habit.

The machinery concerned in this process must be analyzed a little more in detail in order that we may proceed with the subject. The nervous system whether of the human being or any other animal, from the lowest to the highest process, includes two general parts, the nerve center and the nerve fiber. Now I am going to give you an illustration to show what I mean when I say that these two parts are the essential parts of any nerve system. Let us consider a system that is very simple. If I were going to make plain to anybody the parts of a machine I would take for an example a very simple machine rather than a complicated one. So I am going to take one of the lower animals,—an animal that is often referred to in books on psychology—to bring out this fact.

As I have dredged in Casco Bay, on the coast of Maine, among the animals of interest brought up by the dredge has been one we used to call the sea-peach. It is oval in shape, about the size of an ordinary peach, it has an outside covering that is velvety like the peach, and it has a bright red color tinting off to white like the peach. When it comes out of the water

with other muddy sea-animals it is very conspicuous on account of its brilliancy, yet it is an animal. On the board I have made a rough diagram of the animal when it is undisturbed. Fig. 1 represents the general shape of the animal when it is quiescent,—like that of a bag. When it is touched it contracts so that it presents the appearance of Fig. 2,—more like a small ball. Here we have two actions,—the stimulus, and the associated movement. The associated movement will invariably follow the stimulus. Now when the animal is cut open we find one small mass of nerve matter of a grayish color, with white fibers going up to it, and passing from it to the muscles. Here is the nerve center and the nerve fibers, and it is a simple representation of the nervous system of every animal. It is simple because we have only one central mass. You see this central mass must be the center to which impulses are sent, and from which impulses are conducted. The thread-like fibers have to do the work of conduction.

In all animals we have these two parts. If we refer to the starfish we have five masses with fibers, in the clam there are three pairs of masses, in the lobster there is a chain of masses, in insects the chain has more of these parts. When we come to the frog we have

these same kinds of masses located in the head and along the spinal cord. All these masses in the frog we can compare to the one mass in the sea-peach, only multiplied. Now the human being belongs to the same great group as the frog,—the back-bone group, and the human being has these nerve masses in the cranium or skull, at the base of the skull, extending down through the spinal cord, and some distributed in other parts of the body. The fibers go to every part of the skin. I want to call your attention to the fact that the eye, the tongue, the ear, are all on the periphery of the human being, and they are all differentiated skin. There are fibers that go down from the centers to the muscles, those moving parts of the human being, those parts made of up of a kind of tissue that has the remarkable power of contractility.

Now I want to be sure to leave this clear in your mind, that the human brain is only part of the central human nervous system, which also includes the chain of masses making up the spinal cord. This part which I have here in my hand is one of the largest, but it is only one of many masses. I want to make this general aspect of the nerve machinery clear so that the multiplicity of the parts will not be confusing to you.

I have here in my hand a human brain. It was prepared for me to use in these lectures some years ago. It has been hardened so that it can be easily handled and examined. It is somewhat shrunken, and therefore it is somewhat smaller than it would be in the human head. I show it to you so that you may see the parts of the human brain as they really are. Here we have the two large masses which we call the cerebral hemispheres that occupy the upper part. If you examine this brain closely you will find that there are a number of smaller masses in the lower part. I refrain from giving you the names of the parts, as they are not of so much value as the ideas, and some of the ideas are not of special value to us. It is the general anatomy of the brain, that the teacher ought to be familiar with. Here is the end of the spinal cord that has been cut off, here are two large parts, the cerebellum, here is what you have learned to call the medulla. If you want to know what the names of all these parts are you can easily find out by consulting any book on anatomy.

Now I want to take up what we call the cells. One of the great truths handed down from the nineteenth to the twentieth century is this, that all animal tissue as well as vegetable tissue is made up of little microscopic parts that we call

cells. So this nerve tissue of which our brain is made is composed of these cells, just as in chemistry you have learned that different substances are composed of molecules. As the molecule is the unit of the physicist, so the cell is the unit of the biologist.

Now these nerve masses are all collections of these cells. They differ in shape, and they vary in size from 1-300 to 1-3500 of an inch. It is difficult to form an exact image of a cell or molecule. We form a mental image of a speck of dust, and we substitute this for the molecule. A common hair of the head, if it is fine, is about 1-300 of an inch in diameter. We can get an idea of the minuteness of these cells by this. If you looked at a piece of brain through a microscope you would see distributed through it small bodies, some of them star-like, and some of them pear-like. The material of which the nerve cells are made is a jelly-like substance. It is very unstable in its constitution. By that I mean that it is very easily decomposed, that is, changed in its composition. You know substances differ in that respect. You would not have to put a piece of glass into a refrigerator to keep it because its composition is not easily changed, but in summer you have to put a piece of meat into a cool place to keep it, because it is a kind of matter whose composition is changed easily.

This nerve matter is made to act. I want you to think of action in two ways: think of waste, and think of repair. In defining waste perhaps the word decomposition would be as clear to you as any other word I could use. I mean the material decomposes when I say wastes. When I put a stick of wood on my fire the first thing that takes place is that the heat decomposes the wood. It is reduced to charcoal, and finally we have merely ashes left. There we have a kind of action, a case of decomposition. That wood cannot be used over again, it has been wasted, it has been changed, and we have to replenish the fire with more material. Your chemical training prepares you to think according to this requirement of mental science.

Oxygen is so concerned in this action that we could not live long without it,—so concerned that if we did not have this oxygen our consciousness would cease immediately. So the first thing we must take care of is the physical condition of the brain. In order that the brain cells may do their work they must have food and rest,—a period when they are quiescent, when they are not acting so incessantly that the waste will far exceed the repair. Don't you see how important it is that a person who

is to have charge of forty or fifty brains should realize this? Should she not realize the importance of this need of oxygen, food and rest? The reason we have had such serious results in education is that people have ignored these three factors of mental activity. I do not know of any condition in education that should be recognized with so much seriousness as the condition of these brain cells, their need of oxygen, their need of food, and their need of rest.

VII.

NERVE CHANGES.

Continuing the subject of repetition, allow me to allude again to the two general parts of the nervous system concerned in mental acts, the nerve centers, and the nerve fibers. Bear in mind that the nerve fibers pass from the surface of the body to these nerve centers, and from these nerve centers to the muscles, and to other parts of the body. Their function is mainly that of conduction. It may be well to state here also that these nerve fibers pass from center to center, so that all of these central masses are connected with one another by a great many nerve fibers.

Now as to the function of the nerve centers I will be cautious about being too specific. Formerly physiologists venture to state that the nerve centers acted in a way peculiar to themselves, and different from the action of the nerve fibers which is merely that of conduction, but observations are making it neecssary to be cautious about being too specific in regard to the action of the nerve center. However, for us teachers it is sufficient to state that these nerve centers are concerned in some way with mental acts. Some action takes place in

these nerve centers. This is all that is necessary for us to consider in order to realize the importance of doing everything possible to take care of this part of the machinery. We must realize that these centers, concerned as they are in activity, need certain indispensable conditions, such as the provision of oxygen, food, and rest. Now as the blood is concerned in carrying oxygen and food to these nerve centers as well as carrying away waste products, it is important to realize how necessary exercise is for a good brain condition, because certainly one of the benefits of exercise is to hasten the circulation of this carrying agent, which we call blood, and it may be well to say here that it is as important to get rid of waste or useless products as it is to furnish that which is useful to the brain system. Especially as these waste substances are now thought to be concerned with fatigue. It is important to get rid of that which clogs and poisons the human system as to provide nourishment. In taking care of a fire it is necessary to get rid of ashes and clinkers as well as to furnish fresh coal. People often make a mistake in this respect in taking care of their bodies. They often resort to over-feeding, and to the taking of drugs.

Again let me allude to what I was proceed-

ing to say about the composition of the nerve cells. I said at the last lecture that the material was very unstable, and easily changed. Let me add a little to that. Of course these cells are made up of smaller parts, of molecules. The molecule of nerve matter contains many parts. That may be one reason why it is so unstable. You can realize that a piece of quartz that has only three atoms in the molecule is not unstable. The molecule of protoplasm may contain three or four hundred atoms, and you can realize that this is a condition of change, of separation. You can understand that a simple machine like a pair of scissors is not so likely to be deranged as a sewing machine, or a watch, which have a multiplicity of parts.

These molecules are built up, so to speak, during the period of rest or sleep. We realize that the human mind is more alert at some times than at others. We can do almost anything more easily after a rest than we can when we are fatigued. The nerve centers are concerned in mental activity, and it is important for every individual to realize that while thus concerned they are being changed, or decomposed. Professor Huxley in order to bring out the complex aspect of the molecule in the nerve center, and the condition after change, once

gave this illustration. He referred to building a house with cards and pointed out that the more cards one used the more unstable the house was, and the more ready to tumble down. So it is with the composition of this nerve matter, it very easily tumbles down to simpler products that become waste products.

This leads me to the law of growth. I want to state that law in the terms of Dr. Carpenter who has put it into a few words. He says the nervous system grows to the mode in which it is habitually exercised. This is the fundamental process of all your educational work. Let me try to make plain what is meant by "grows to the mode." It implies the breaking down of tissue, and the building up of the same. This is what growth means,—waste and repair, separation of the parts, and nourishment. Now the parts of a tissue change, and do over again more easily what they were concerned in doing when they were worn out. This is what that law means. So you see if we practice any movement habitually, that is, repeatedly, when the tissue is built up again it is built up so that it continues to do over again that particular act that it was worn out in doing. This underlies the work of training muscles as well as the work of repeating ideas. In this light we can realize what the German

physiologist meant when he said that we learn to skate in summer, and we learn to swim in winter. He meant that we have the practice of skating in winter, then during the summer those nerve centers become quiescent, and are repaired, and after this process they can do over again better than before what they were broken down in doing during the skating season. I used to notice at the gymnasium that if I rested a day or two I could do things better than I could before. It seemed to me that during these periods of rest the nerve and muscular tissues had a chance to be built up again, so that those actions could be done more easily after the rest than before.

Association.

Now I will hurry on and state another law that is equally important,—the law of association. It is this, when one action is performed in connection with another action a great many times they tend to cohere, or to be associated, so that when one term of the sequence is repeated the other term will be repeated. Now that implies that there are more terms than one, there must be at least two terms with which that law is concerned. There may be an irritation and a movement, or there may be two movements, or one movement and an idea, or the terms may be a sign and an idea, or an

idea and emotion. In the case of the frog one of the terms was a stimulus on his skin, and the other a movement of the muscles that had been repeated whenever there had been a stimulus on the skin. These two experiences so cohere in the life of a frog that when one is repeated the other will be repeated. In the case of movement we often find that when one muscular movement is executed another will follow if they have followed in sequence a great many times. Talking is referred to that law, and in school work writing is also referred to that law. In writing each movement of the hand is a stimulus to the next movement. This is true of words in a language whether it be a sequence of intelligible words that express sense, or merely a sequence of unintelligible words. One muscular movement of the vocal organs having been followed by another, when one is repeated the other will follow, as when I say a-b-c-d the muscular act in naming a is a stimulus to that of naming b.

Again we have an idea and movement. A child has an idea and he jumps up and does something. We have a sign and an idea, as reading words in a book. We look at the sign on a printed page and we have the idea, that is associated with that sign, brought into consciousness. We look at an ink mark of a score

of music, and if we have associated a certain tone or pitch with that mark, that tone will be dragged into consciousness when we see that sign. These associated actions are so bound together according to the universal law of our being that if we have one experience we shall have the other. You can see how important and fundamental this law is, and let me say to you that one reason why there has been so much waste in teaching many subjects is that teachers have failed to recognize the fundamental character of this law. I will give you two illustrations to emphasize this further.

I have on the board in Fig. 1 a diagram representing a vertical section of what we call the upper, and some of the lower centers of the human brain. Now let me show you how learning to talk is an illustration of this law of association in which actions become automatic and bound together. Let us refer now to a child. The child sees an object. The act of seeing consists of waves of light being reflected from the object, a cat for example, to the eye, then nerve impulses are sent through the optic nerve to the lower centers of the head, and thence to the upper centers, and we have formed there a visual image accompanying the action of the brain. Now there is also in the environment a word spoken. Waves of sound strike the end

of the auditory nerve. The auditory nerve is stimulated, something is sent to the upper part of the brain, there is an accompanying action, and we have a sound image. The visual and sound centers are connected by nerve fibers, thus providing for the association of actions. Now when these two experiences have been repeated together a certain number of times, they become so associated that when the sound image is brought into consciousness, the visual will follow. So if a child hears the name cat as often as he sees the object, he will know cat when he hears the word.

I had a very striking instance of this once when I was in the town of Brookline, for the purpose of giving this lecture. I was walking along the side-walk and passed a nurse wheeling a baby carriage. After I had passed I heard the baby say "bow wow." I turned and saw the baby pointing to a stone lion at the entrance of a large estate. The child had seen something like the lion, namely, the dog, and he had heard the sound "bow wow," and when in this case he had called up in his mind an image like the dog he also had dragged into his consciousness the sound "bow wow" which had accompanied the visual image.

The teacher must fulfill this same law in teaching a child to read because it is concerned

with the same law of association,—the sign with the idea, so that every time a child sees a word he has brought to his consciousness the name, and also the visual image. A teacher should get a clear idea of this, and follow it out most faithfully. The teacher who teaches reading successfully follows out the requirement of that law, and the skilled teacher is one who is an artist in drill.

Habit.

We come now to the subject, habit, which is simply another phase of this repetition, and is involved in various activities. Some habits are more automatic than others. Some we can hardly distinguish from reflex action. We generally speak of habit as distinct from reflex action in that it is an automatic action, acquired by the individual.

Let us take an example of the acquiring of a habit. A person learning to play the piano forte first looks at the music and gets an image of the sign on the staff. The nerve impulses from that experience go to certain brain centers, and then under the direction of the will the centers concerned with movement are made to act, then nerve impulses are sent down to the muscles, and the fingers strike a certain key. He repeats that very deliberately, it is a slow process at first, but after a while, after

much practice, those muscles of the arm and finger are made to act so that they will strike different keys very rapidly, and just as soon as this becomes automatic it is a habit. I want to call your attention to the fact that the part which is slow, and requires guidance, depends upon memory, until after sufficient practice, it becomes automatic, and does not require guidance. The performer must be relieved of the necessity of guiding his movements, for his mind must be concerned in realizing the higher feeling of the composition, and in giving it expression. A man once counted the movements of a performer on the piano, and found that she made 5,595 movements in four minutes and three seconds. You can realize that a person could not think as fast as that.

This automatic phase becomes very important to us when we realize how many of such actions there must be.

I have referred to the upper centers and to the lower centers of the brain. By lower centers the physiologist generally refers to those masses below those in the upper part of the head. It is believed that when those lower centers act there is no associated mental experience that we can consider as conscious. So in acquiring a habit we must relegate to the

lower centers as much work as possible. In the case of the frog all its acts were performed by the lower centers, because the upper centers had been taken out.

We have many amusing instances given to show what the lower centers will do. Reference has often been made to the soldier who was carrying a pail of milk in one hand, and a bundle in the other, when some one shouted: "Attention!" The muscles that had been accustomed to obeying this command acted, and the bundle and the milk had to go.

I once heard a story of a busines man whose upper brain centers were concerned with certain matters of business while he was going home to dinner. His wife, meeting him at the door, told him to hurry as they had company waiting for dinner. The man, still thinking of business matters, went upstairs. He took off his coat, and the lower centers performed the actions usually following this act, and when his wife came to look for him some time later she found him in bed.

You all have experiences of this kind. You will not have to guide yourselves home this noon, your lower centers will do that.

I have repeatedly said to the young ladies when they have finished a recitation, "That is sufficient." One time when I was presiding at

a meeting a man finished his speech and I said, "That is sufficient."

At the close of the teachers' meeting I often have to check myself from saying, "Class is excused."

When I go home to my father's house I have difficulty to refrain from putting my hand into my pocket, and taking out a key. In my early life I had gone up the steps and taken out a key so many times that those two acts had become by repetition associated.

It is worth your while to notice how these lower centers will do what they are called upon to do without any conscious direction.

This leads me to emphasize the importance of this automatic action which we call habit. In order to carry on the duties of life it is the law that we must relegate to those lower centers as much work as possible in order that the upper centers may have the energy to do the higher things in life. Many of our actions such as walking, going up and down stairs, opening and shutting doors, dressing and undressing, using tools, and many others must be so acquired that they will need no conscious direction whatever. So when we come to school work we shall see how much must be relegated to the lower centers.

VIII.

HABIT.

Now I will take up the subject of habit where I left it at the last lecture. I was about to point out that habit is of special value in much of school work. The point of view that I want to emphasize is this, that in many things the teacher has to do in the school room her aim to a great extent should be habit rather than knowledge. We may express their relative values by diagram in which we represent knowledge as of limited importance, and practice, or that which produces habit, as very important.

Beginnings of Reading.

I will refer again to reading words, and reading music, as illustrations of this thought. I refer to the beginnings of reading. Of course there are two aspects in teaching reading in the schools. One we call the beginnings, in which we are concerned with associating printed words with ideas. The other aspect is concerned with the content of the reading, in getting ideas or emotions. I want to make plain to you what I mean when I say this part of psychologly is of special value in teaching the beginnings of reading. People have ignored

this fact, and have talked of the necessity of knowing the names of letters. What do they mean by knowing the letters? They mean the ability to know the names of the letters. Let us test this. Let us take that word cat, that has played such a prominent part in education. Suppose we follow this prescribed course. What is the result? The individual knows see-ay-tee, the names of the letters that spell the word. What does he know as a result, It is preposterous to expect anybody to know cat simply by knowing the names of the letters of the word.

Some people emphasize the sound of the letters, and this has more of reason on its side, but after all in committing to memory, or associating, the sounds of letters we are in danger of going a round-about way to teach the beginnings of reading. When you and I read we look at a page, and, to use a common term, we have committed its words to memory. When we come to a word whose idea we cannot recall we hesitate, and have to learn to read that word. I believe that those teachers who have succeeded best are those who have analyzed this special part, that the result to be obtained is the association of the visual image of the printed word with the sound word or idea, and they have realized that this association must

be automatic. The only way to obtain this result is by practice. There is no other way. This is the way in which we have all learned to read, whether we have learned it by the alphabetical or phonetic method.

The same is true of reading music. Before I proceed to that I will add, that anything in the way of phonics, learning the names of letters, or learning to spell that can be utilized in attaining this for the main purpose is justifiable, so long as the teacher does not exalt it to an end. Reading music is also a process of association. Signs that are seen must be automatically associated with sounds that are heard. Let me point out this, that it is wasteful to attempt to spend too much time in having children learn what a clef is, or what the signs of a key are, in the sense that they must be put into words, when they ought to be seeing, hearing, or sounding the notes. Children often surprise us by the progress they can make when we take into consideration the machinery, their brains, that they must use, and pay some heed to the way in which those brains must be used in order to attain the end we desire.

The same is true also in regard to writing and spelling. Automatic association, that phase we call habit, is the end. Therefore that

course that provides the most practice will be the most successful course.

We now come to language sequences. I have purposely used the word sequences here, because whatever the language may be it is a sequence of words. We put words after one another according to best usage. The condition of putting words after one another is practice, so that the sequences will be habitual, as I said in the first lecture. The proper arrangement of words depends upon arrangement as the notes of a melody do. When we sing our wills have very little to do in putting the notes after one another. The same is true of putting words after one another. A person does not use corect forms of syntax because he has learned rules. So in language, if we aim at the art of language, that is, if we aim at speaking and writing the language, this principle of psychology is of paramount importance. The reason that there has been so much waste in teaching foreign languages is that the people who have been concerned in teaching these languages have not recognized these principles of psychology. If they aim at reading and speaking the language, and I cannot imagine anything else worth aiming at, then the principle that should guide them is that of automatic association, and the only way of attaining that

end is incessant practice. We have spent a great deal of time in learning syntax and much about language, but after years of such study we are unable not only to speak the language but even to read it. If the best success is ever attained in the future in teaching Latin, Greek, or French and German, it will be accomplished by those teachers who have studied in a profitable way the psychology of the minds of those whom they are teaching, and who have discerned the principles that they must observe.

The same principle must be observed in arithmetic if the end is to be the art side, not the science side. We have been taught the science side of both language and arithmetic, but so far as we dwell upon the science we neglect the art side of these subjects. When I refer to ciphering I mean doing arithmetic, getting results with figures. We aim at association that must become habitual. Take for example thinking, two and three, and having five as a result. This must be an automatic process. Learning all the combinations that make up the multiplication tables consist in associating figures. If we have to stop to think, or even to remember, we have not proceeded far enough in the work in arithmetic. I cannot go any further now in my analysis of arithmetic, but this ought to suggest to you that the arithmetic needed in life is

the art side of arithmetic which involves practice.

In muscular actions in gymnasium work we do not depend upon knowledge, but upon practice. Dancing brings this out. How many dancing teachers will proceed to analyze the waltz, and try to have people know what the steps of a waltz are. Have you ever observed anyone trying to dance by knowledge? They are very conspicuous until they get out of the knowledge phase. They are conspicuous because they are conscious. Dancing consists in making certain movements in sequence according to time. The thing to do is to have a model to imitate. After you can make these movements correspond to certain time by practice you have learned to waltz, and you may not know what the steps of a waltz are. All gymnastic exercises are based upon this principle. You teachers in the gymnasium have an opportunity to train children to walk. Walking consists in making a certain series of movements in sequence. Not long ago I saw a brigade of twelve or fifteen hundred high school boys in a parade, and I saw very few boys in that brigade who walked creditably, or carried themselves properly. This is very obvious when you observe the children of the public schools. The only way to train people to a proper car-

riage or posture is to train the muscles by constant practice so that easy muscular movements will follow one another without any guidance whatever.

Conduct is another part of our school work in which habit must be an end. This is especially true in two phases of conduct, the care of the health, and the civilities of life, that is, the deportment, what we often call etiquette. It is not so much knowing that we should take care of our health, that we should be unwilling to sit in a room where there is unwholesome air, that we should be regular in our food habits, and abstain from indigestible food,—it is not knowledge that is of the greatest importance, it is habit. So many people in teaching hygiene fail to realize that. Those who teach temperance make the mistake of thinking that knowledge makes people temperate. The people who are temperate do not depend upon knowledge, but upon habit. This is also true of the civilities. It is not the extent to which you tell a child, "This is not polite," or "You must not do this," that the child is well-bred. It is the extent to which the teacher makes the child practice over and over again the civilities so that he cannot help being polite. The person who attempts to be polite by rule is just as crude as the person who attempts to dance by rule.

You see that I have emphasized the doing side of our education. In all parts of our education in which doing is the important element practice is necessary. "We learn to do by doing." This aphorism is not new, it is as old as the human race. I will leave this subject by saying again that it is that part of education that involves doing in connection with which this aphorism, "Learn to do by doing," is the important feature. There are other parts of our education in which practice and automatic action are not the important features. I saw this brought out in Harper's Monthly some time ago.

"The worlds in which I live are two,
The world I am, and the world I do."

I have been talking about the world "I do."

I will continue this subject of repetition by taking up another phase that we call memory. The special part of memory is this tendency to do over again. It differs from the other phases, reflex action, and habit, in that it may be regarded as a weaker tendency to do over again. Its power to repeat may be spoken of as temporary, for it sometimes subsides, and cannot be realized, whereas reflex action and habit are more permanent. Memory differs in many respects from reflex action, though this is the

important element. It is unlike habit and reflex action in this respect, that when we have memory we can locate the event in time, not only that, but we can also locate it in space,—we know where a certain thing happened.

I do not propose to analyze here in what other respects memory is unlike these other processes. I simply want to point out to you that memory is not a general faculty in the sense in which it has been regarded. Certainly people have talked about memory in a way to imply that they meant by memory a faculty that in a general way does all the reviving or repeating. People say they study a certain language because it trains the memory. What do they mean? That it so trains the memory that they can remember anything. So they think memory is a general faculty for repeating. Now there are as many memories as there are different ways of repeating knowledge that is gained. I will say that I believe in the teaching of psychology that brings out that when a mental process is repeated, exactly the same part of the brain acts over again that was concerned in acting at first. I will not attempt to say that these processes can be located in the brain too specifically, I will only say that there are certain brain areas that do the work. I believe that when I see an orange, and after-

ward remember that orange the two processes are the same. When I remember a melody I believe that the action of the brain is the same as when I first heard the melody. Don't you see what a different aspect psychology teaches when we consider these two experiences? Don't you see how inconsistent it would be to say that by studying words we train a general memory? If this were so actors ought to have prodigious memories, but it has been found that this is not the case, though they do gain facility in other kinds of word repetition.

This leads me, in closing, to point out the importance of memory in all our educational work. You often hear memory spoken of in a depreciating way, but in all our mental acts we must depend upon memory. If a person could not repeat today the ideas he has gained in the past, think how helpless he would be. I shall take up next some of the facts in favor of this aspect of memory that psychology teaches us, and then review some of the conditions favoring memory.

IX.

MEMORY.

I wish to repeat, on account of its importance, a statement in regard to memory that I have already made. It is this, when we remember, the same parts of the brain act over again that were concerned in the first action, whether it be the act of forming images, or the act of producing movement. We can realize the significance of the idea that we have different memories only on the basis of that view, so we may consider that the individual has a visual memory, a sound memory, or a tactual memory. This is very important for the teacher to take into account, because in her art of teaching she realizes that she has different individuals to deal with, and she must give all a chance for utilizing their natural endowments, so that if a person by inheritance has a good visual memory he ought to have a chance to use it, or if he has a good sound or tactual memory he ought to have a chance to use that also. This is the reason why in teaching spelling, although we may never have to spell unless we write, we should give drill in oral spelling, in hearing the words spelled repeatedly, as well as seeing the word,

or writing the word. In different exercises of this kind we are drilling on different kinds of memory.

Now let me give you one or two illustrations to make this plainer. People who use the microscope sometimes testify that after a prolonged experience of a number of hours with the microscope, in looking at objects and repeating the visual images many times, after leaving the microscope the visual images still persistently recur. The persons continue irresistibly to see the same objects that they have had long experience in observing. The brain seems to continue to repeat those visual experiences. After sailing on the water for a number of hours you have all had the continued experience of realizing the wave motion of the water after you have come ashore, and you have a feeling as though the sidewalk were going up and down just as the boat did. The brain parts concerned with tactual feeling repeat those tactual experiences which they have had much practice in for a number of hours. If we have attended an opera, and have heard a certain tune over and over again, we often say, after leaving the opera, that we cannot get that melody out of our head. The brain centers continue to act. Do not these few instances seem to point out

that the same parts of the brain act over again in memory that acted when the influences of the environment were present?

I will give further evidence of this, and will consider first the case of injury to the brain. The text-books on psychology give a great many recorded instances of memory being affected by injuries, diseases, and other influences. I will call your attention to just one or two of these cases, that are very interesting in their instructiveness. I can think of one case recorded of a man who had spoken the Welsh language in his youth. He had been away from Wales a number of years, and had forgotten his own language, but upon recovering from the injury of a blow on the head he could speak the Welsh language fluently. In an accident a man was struck upon the head, and upon his recovery he could not recall his knowledge of Greek. A lady, after receiving a blow on the head, found that she could not recall her knowledge of music. Another instance is that of a gentlemen who fell from his horse, struck his head upon some hard object, and was so injured that when he recovered he could not remember that he had wife and children. One of the most striking instances of partial loss of memory is that recorded in the life of Sir Walter Scott, who suffered a severe

illness while he was writing one of his books, and when he had recovered could not remember the characters and incidents of that book.

In cases of disease we have phenomena of memory that are very instructive on this point. Perhaps one of the most remarkable instances on record is that of a servant in a German family who was taken sick with a fever. She was a young woman who could not read or write, and yet during the delirium of her sickness she gave utterances in the various Latin, Greek, and Hebrew languages. They were so consecutive that they were startling, and caught the attention of the attending physician, who upon tracing out the case, found that the young woman had lived for years in the family of a clergyman. It was the practice of this clergyman to walk in the corridor and repeat selections from the Latin, Greek, and Hebrew languages, and the brain cells of this poor woman had been so bombarded with those language sequences that under the unusual stimulus of the brain they were repeated. This is not a fanciful case. It has the best authority, and has been quoted by many writers on psychology on account of its instructiveness.

Another case of a Welshman is recorded. He had forgotten his language because he had not spoken it for years, and while having a fever

used his language fluently, but when he recovered he could not remember it.

I can recall a case that came under my own observation. I was calling once upon a gentleman who was suffering from a fall from a carriage. He had struck his head upon a curbstone, and had been seriously injured. While I was in his room a clerk from his business house came in, and asked him to sign a paper. He signed it, the clerk went out, and we went on with out conversation. A number of days after the man had convalesced he came to me with a worried look, and asked me if he had put his name on that check. "My dear sir, you certainly did," I replied, "for I saw you do it." His brain was in such an enfeebled condition at that time that it could not repeat the action.

The well-known disease of aphasia is a condition in which a person can remember ideas, but cannot recall the words for the ideas.

I have given you these instances that you may realize the significance of this idea, that when we refer to different memories, we refer to different parts of the brain acting over again, and if those parts of the brain are affected, then this power to repeat, which we call memory, will be interfered with, and impaired, —it may be checked so that we cannot realize

it for days, or even months. Do not all these instances seem to verify the statement that we have different memories, and these memories depend upon the possibility of the different parts of the brain acting over again.

Aids to Memory.

Now I come to that part of the subject in which I want to point out some of the aids to memory. First I shall emphasize the physiological condition of the brain as an important aid. The importance of the physiological condition of the brain is brought out by the fact that children can remember things better than adults. This is so because in a child's brain the conditions for repeating are more favorable. When you observe that after reading some words to a child a number of times he can repeat those words, you can realize that more of an impression has been made upon his brain. Don't you see therefore how important this aspect is for the teacher, and how important it is that she should see that the physiological condition of the child's brain, in these respects which I have mentioned, are favorable to memory? Important things can be given to children to remember, such as repeating good selections of poetry or prose, seeing good pictures, and learning good music.

Let me cite to you one illustration of the work we are doing in our Model Schools. We are teaching geography in the lower grades. We are having children look at maps. Why? Because they will subsequently need to see and to remember these maps. You and I can remember the map of North America, South America, Europe, Asia, the Philippine Islands. If you cannot, your education has subsided a little. This is memory. It depends upon our seeing these maps a sufficient number of times so that the visual images can be repeated. Now the condition of the brain in old age depends upon this part that we have designated the physiological condition of memory. The other day a gentleman told me of an old lady in an Eastern town who was ninety years old. She could not remember the things she had heard the day before, or even the names of her own family, but she could spell better than any of the children in the village. She was still alert in repeating the letters of words she had heard almost ninety years ago. During her early life, when her brain was in good condition, these words as she spelled them had been so impressed upon her brain, the change had been so registered, as the psychologists say, that they never were obliterated. When I speak of registering change I mean that there has been

waste and repair, or growth. This is true of old people in general. They cannot remember things they have recently acquired, but the memory of former experiences is ever possible. I know of a noted man of letters who in old age had to depend upon others for remembering some of the commonest things. He went to the funeral of another literary man whom he had known as well as any member of his own family. When he looked at the form of the man he said, "I cannot recall that man's name, but he had a gentle nature." So we find in old age that the physiological condition of the brain is less favorable to memory, and those kinds of memories that have been the least provided for, are the first that go.

We notice in our own experience that fatigue affects our power to repeat. We know that some things we cannot remember at night come to us in the morning. We have all perhaps had the experience of not being able to recall lines of poetry which at other times, when we were alert and fresh, we could remember. I have repeatedly had this fact demonstrated in my own experience, that a rest from sleep makes the brain more capable of doing over again what it has done before. Sometimes in the night under unusual stimulus the brain will act over again, but it is because there is an unusual

stimulus, as sometimes a tired horse under whipping will go a little faster.

Another aid to memory is the well-known condition which we call attentive repetition. If we wish to be able to repeat anything, we must practice, and of course this makes plain to the teacher the necessity of drill. It is not necessary to dwell upon this phase of helpfulness unless to emphasize this, that teachers often fail to realize that drill has been neglected, and they often expect children to remember things when they have not been sufficiently drilled.

We often hear it said, "That man made an off-hand speech without any preparation whatever." Let me tell you that generally the ideas in an extemporaneous speech have been thought over and over again. I remember Mr. Beecher was in the habit of talking off-hand. On being complimented on his sermon being remarkable as an extemporaneous effort he replied, "Why, my dear sir, I have been twenty years preparing that sermon." He was such a reflective man, he had so thought over his subject, that his ideas were ready to be expressed.

The point I want to emphasize is that if you want to have ideas to express you must practice thinking ideas. I surmise that often in our

recitations the reason why pupils cannot express ideas is because they have not rehearsed them enough. In order to have facility in realizing a line of thought you must rehearse it. I believe this is the main significance of reflection. Those people are the most intelligent people who, from some motive or other, usually from interest in the subject, repeat over and over again their ideas. Then they know the subject, and the reason why people do not know is, not because they have not had ample chance for instruction, but because they have not realized that repetition makes their intelligence available, and is the condition for memory.

I will venture to use these two expressions in regard to memory,—ready memory, and latent memory. These words are convenient for me to use at this point. When we can readily repeat anything I would say that we have a ready memory. By latent memory I refer to those parts of our acquirements that we cannot readily revive. They require favorable conditions, certain association, or some kind of stimulus. Now let me illustrate what I mean. Many of you have pursued branches of study such as those you have followed in the High School, and it has been your experience to say, "I cannot remember anything, or I cannot re-

member much, of what I learned in that subject," and if you have taken a text-book and gone over the subject you have been impressed by the fact that you could remember the subject far better than you could if you had not studied it before.

A young man told me that once he decided to taken a certain examination at the university for a prize. It was on the subject of calculus, which he had not studied for some time. He went over to the college library, looked over some examination papers, and found he could not answer one of the questions. He took a text-book on calculus, and in a few hours went over the subject. He afterwards took the examination and answered every one of the ten questions. In a few hours he was able to fit himself so that he could remember what it had taken him a year to acquire, so there must have been some part of that memory that had not been obliterated.

It is encouraging to know that the intelligence responds in many ways upon a slightly favorable condition. I believe that the word, culture, is applicable to this condition. The best culture is that intelligence that is made up of such parts as can be revived in response to the best external influences. Culture depends upon the memory condition. It depends upon

that condition that can be awakened when we come into certain relations, and the great question for educators today is what culture is of the most worth, and what memories are the most worth cultivating.

If we ask a pianist to play sometimes we have heard her say, "I am not in practice,—I have not practiced for three weeks," and we excuse her. It is common to excuse people who say they have not used their muscles for a few weeks, but there are some people who think it strange because their brain centers cannot revive knowledge with which they have long had no practice. Why should we not use the same expression with reference to those parts of our brain that are concerned in higher phases of knowledge namely, "We are not in practice." So we must keep our minds in practice along those lines which we wish to repeat, and we must not think it strange if people cannot remember some things they have not had recent practice in remembering.

I often think it is unfair for people to expect so much of those who come out of the schools. It is interesting to me to see that lawyers, when consulted in regard to a law, say, "Leave me the facts, and I will look it up, and see what the law is in this case." The physician also gets the facts of the case, and then looks it up.

It is quite common to refuse to give the same privilege to people who leave the schools. So again I say that we should not expect people to remember those things that require practice in memory, when they have not had this practice.

I will stop here and take up the other aids to memory at the next lecture, and I will also begin the subject of attention.

X.

AIDS TO MEMORY.

I will continue to speak on the aids to memory. The third aid that I propose to deal with I have designated as the intensity of the first impression. We have all had experiences that have been remembered without repetition. We have all said something like this,—I shall never forget that experience, that sight, or that sound,—although we may have had only one occasion for acquiring the idea. It seems as if, on the brain side, that the condition for memory in such a case must be that the brain action is unusually affected. It seems that the change in the brain for some reason or other must be greater than usual, and therefore the condition for reviving is more favorable than under ordinary circumstances. We cannot say anything more definite about that condition. Such instances are generally associated with some feeling, as fear, wonder, curiosity, joy. Perhaps the influence of the emotion prolongs the change to the extent that it is pronounced, that is, it is easily repeated. The fact that under some circumstances only one, or at least a few experiences are necessary for revival makes plain why a teacher should if possible make the first experience impressive. This

truth underlies all objective teaching. The teacher is aiming in objective teaching to provide for memory. We are doing this in all our education. We aim to give instruction so that acts may be done over again with as little effort as possible. So when a teacher proceeds to give instruction on an idea, by bringing the environment into the presence of the child, by making some action or object affect the brain directly, she is recognizing this particular truth in regard to memory. She is trying to make such a change in the brain action that there will be as little need of repetition to ensure the repetition of the idea as possible. I might allude here to this thought that comes into my mind, that perhaps this effect in brain action is all we produce by repetition. I can think of this illustration which we must use cautiously. A person with a very strong, pronounced stroke can make a deep impression upon some hard object with one action, but just as deep an impression can be made by repeatedly using slight strokes. So the circumstances attending an idea may be such that the same effect will be produced that is otherwise produced by repeating less influential acts.

The next aid to memory that I shall dwell upon is that included under the general law of association. I have already referred to the law

of association, and have stated it very carefully. This is the special application to the phenomena of memory. In connection with memory when ideas are associated by the relation of nearness in time or space, or by the relation of similarity, then they seem to be revived by one another. Whenever we speak of association of course we refer to relation. You observe in this special case I am specifying the relation by which mental acts may be connected. Let me try to make plain what I mean by the association, or the relation, of nearness in time or space. I will use as an illustration a common experience. When a person wants to remember an idea he often resorts to a simple device, like putting a string on the finger. Now the principle involved is this. The string is put around the finger at the same time that the idea is in consciousness. The string will be before the person's eye constantly, and when he sees the string, according to this condition of association in time, the same idea is revived that was experienced when the string was put on the finger. When a person uses notes to help him remember ideas that he wants to express, just a few marks made at the same time that he had those ideas when listening to a lecture, or preparing a lecture, will enable him to recall those ideas.

We have many illustrations of the truth of this condition of memory. In common life our surroundings are constantly reminding us of former events, and of former parts of our lives. From travel we can pick out very striking illustrations of the application of this principle. We may go to a place where we have been before, to the sea-shore or to some country place, to the home of a relative, or to some hotel. We see things that remind us of the experiences we had there about that time, or near that particular place. It is not necessary for me to attempt to give many illustrations of that, for you can all recall experiences of that kind. I will give two illustrations that are very striking. I have here a piece of plaster with paint on it that was put there two thousand years ago. This piece of plaster was taken from the house of Glaucus of Pompeii,—the house that has been made so famous by Lord Bulwer in his story. "The Last Days of Pompeii." When a person looks at that now, don't you suppose many scenes come into his mind that are associated with the place from which he took that piece of plaster,—the ruins of the place, the rooms of the house, the pavement, the picture of the dog, the Latin inscription under the picture, and the ruins of other places in that city. Just a thing

like that, by virtue of its association with time and place, can make memory possible.

Here is a piece of black lava. One of my family stood on the side of Mt. Vesuvius and put a stick down into the running stream of lava that was as red and liquid as red hot iron coming from a foundry furnace, and took it up in a plastic condition, and then saw it cool and become hard and black. When the person looks at that now, ideas that were associated with it are recalled to mind because of the relation of nearness in place and time, when it was a part of a former experience.

This is a very general condition of memory. It is the basis of all kinds of experiences. All memorials are based on this mental truth, that when we look at a certain thing we may be able to remember events associated with that thing. When I go home to Maine I pass by the Bunker Hill monument. When I look at that shaft of granite extending upward I cannot refrain from remembering a number of ideas. Webster, in his speech, expressed that law of memory when he said, "It is a plain shaft, there is no inscription fronting to the rising sun from which the future antiquarian shall wipe the dust, neither does the rising sun cause tones of music to issue from its summit; but at the rising of the sun, and at the setting of the sun,

in the blaze of noon-day, and beneath the milder effulgence of lunar light, it looks, it speaks, it acts, to the full comprehension of every American mind, and to the awakening of glowing enthusiasm in every American heart." Webster was expressing a broad psychological principle. You can see how wide-extending this special principle favoring memory is. I hardly know where to leave this subject because it is so large.

There seems to be an important physical condition by which the mental states are bound together, and by which one mental state drags into consciousness another. This is so fundamental that one recent writer has used the expression "associative memory," and by this widely applicable expression he has ventured to designate all mental consciousness. We can appreciate that phase of mental action when we recall the structure of the human brain. Nerve fibers traverse the brain in every direction, in this way connecting every part of the brain. Does it not seem, so far as we can understand it, that this is evidence that this is the condition of all kinds of thinking? When physiologists speak of brain tracts they refer to the ways by which nerve energy can be conducted. And why is it not reasonable to think that when two acts of consciousness are pro-

duced the physical condition may be a passing of nervous energy from one part of the brain to another in some way?

As I sat before a school yesterday and heard the children recite some poetry I was intensely interested in the different means of expression. Some of the children expressed themselves not merely by uttered words, but by various contractions of the muscles of the face, some contracting the brow, and others contracting other parts of the face. On the other hand some of the pupils recited without any outward evidence of intense inward feeling, but uttered the words in a calm and reposeful way. With some there was more internal feeling than with others, and in order to give an outlet for this nervous energy the muscles had to contract. So we have presented to us in every phase of brain action the passing of nervous energy over tracts. Therefore does it not seem possible that the brain condition of many fibers passing from one to another is just the physical condition that we should expect would underlie this law of association. I mention the brain side because you remember I said at the beginning of the course that I would constantly refer to these psychological truths in the terms of the brain, which I believe are the more definite terms.

I cannot take up at length the states of consciousness that are associated with memory acts that I referred to at the beginning of the lecture, namely, the state of consciousness by which we locate in time and space these memory acts. It would perhaps be an interesting matter to consider and to speculate about, but it does not pertain to school teaching intimately enough to justify my taking the time to do so. I can think that perhaps the reason why we can locate in time is because there are faintly revived with any particular memory act other acts intervening between the present and the past, and hence we can put the event back to a certain time. We can locate in space by faintly intervening objects that come between. It is interesting to note here why time is long to children. It is because they revive more events than a person does in adult life. According to the third aid to memory the events make more of an impression in a child's experience that in an adult's, he remembers more, and therefore more intervening acts are revived in his memory. This is the reason why the time seems so long when we are waiting for a train. Everything comes into the consciousness, and we measure the time by the intervening ideas. As we grow older fewer things make a deep impression on us, we forget many

things, and therefore the year seems shorter. The possibility of memory is forgetfulness. If we did not forget, memory would be almost impossible, because there are so many things to remember that it would be confusing.

Attention.

I come now to the subject of attention. In regard to attention I want to say very carefully at the outset that I shall designate it as a state, or as a mode, that is, the word attention, as we use it, should be applied not to anything like an entity, not to anything as definite as we might mean when we say a part of the mind, but to the way in which the mind acts. I am proceeding very carefully as this is a very important analysis. In the act of attention I think that the brain is acting more effectively in one particular way than in other ways. Therefore that particular state of consciousness that accompanies that particular brain action is more prominent. Other parts of consciousness are quiescent, they sink into abeyance, while this particular part rises to ascendancy. In the act of attention in seeing, that part of the brain concerned with the visual image is probably more alert than other parts, therefore the visual image is conspicuous in consciousness. When we say that we secure attention we mean

that we cause the brain to act in a particular way rather than in other ways, and therefore we make the mind act in that way rather than in any other way. This is true whether we refer to ideas, or muscular acts. We have attention in muscular acts when that part of the organism is acting that we want to act, and when we are doing certain things with our muscles, the fact that we are doing those things in that way is attention. So you see that by attention I refer to the way in which the mind acts, and not to any particular faculty of the mind. You can see how important this becomes in education, for if you can only make the learner's mind act in the way in which your mind is acting, then you are educating him. You are instructing that individual if you can make him have the same ideas that you have, or do the same acts that you do, so of course the whole art of teaching lies in securing attention.

I want to refer here to what Mr. Herbert Spencer says about the different orders of ideas which seems to verify this view of attention. He says that acts of the same order interfere with one another in this matter of attention. Take for example the matter of seeing. Seeing one thing interferes with seeing other things, but sensations of different orders do not

interfere with one another. We can hear words or other sounds such as music, and at the same time form visual images, and the sound images do not interfere with the visual images, but you cannot carry on two sound experiences together very well, because one sound experience interferes with the attention which you must have for the other. You cannot listen to two persons talking very advantageously, but you can listen to a person talking, and at the same time see things. The part concerned with hearing is somewhat remote from the part concerned with seeing, therefore we can have the two actions at the same time.

Law of Attention.

Now the law of attention I shall express in this way. There is always some feeling or emotion associated with that act to which we apply the word attention. Think what a universal law that is if stated in that way. If you wish to secure attention you must always provide for the experience of some feeling. The feeling is always present when you have attention. We often designate it by the word interest, but by this term we always include some phase of emotion, or feeling. Interest is that which keeps the mind alert. You never have attention unless you have interest. When you think

that some people advocate securing attention to things people do not want to pay attention to, this seems to be inconsistent, but if you analyze such a case you will be sure to find some feeling connected, though remotely, with the act of attention. You cannot think of any law more important than this, because in all work we must provide for the feeling. After awhile the condition of attention you provide for is that of automatic association. This, in itself, is abnormal attention, and does not come under what we are now considering.

The rule that grows out of that general law is this, associate the feeling of pleasure, satisfaction, desire, or any other kind of emotion with the action, either mental or muscular that you aim to produce, and which we call attention. The teacher's business in her art is to find out what feelings she can use. I have simply designated these three to show that there are different kinds of feelings, or emotions. I do not use the word emotion in the hysterical sense, but to distinguish from a class of experiences that we call intellectual experiences. In school work, therefore, if a teacher is trained and intelligent, she is constantly trying to find out what the feelings are that are associated with her work. Then she can make a child do her work. This has been the experi-

ence of teachers all through the history of teaching. The older teachers used to work in a way we do not quite approve of today. They used to appeal to certain feelings, such as fear, but we question as to whether they appealed to the right kind of emotions. I will take up the subject at this point, and try to show how the trained teacher, in her art of teaching, is trying to obey this law of attention.

XI.

LAW OF ATTENTION.

Let us analyze a little further this law of attention. Let us consider with the help of one or two illustrations how far it is true that feeling is associated with the act to which we apply the word attention. I will consider the case of a very young child. An infant shows us an example of a condition in which there is no attention manifested. A young infant presents, in a striking way an erratic tendency, that is, a tendency to wander from one experience to another. When he gets along in life a few weeks, suddenly the members of the family observe that the baby is paying attention. He may be discovered staring fixedly at the bright light. The fixity of his gaze indicates that he is paying attention. As the baby looks at the bright light, or the red worsted ball does he not seem, by the movements of his hands, by the activity of his body, and by his smiling, laughing expression, to have a pleasurable feeling attending those visual images? The very fact that he is smiling shows that he has a feeling of pleasure, and therefore he prolongs that experience beyond his usual habit. Now if you ask me why having experi-

ence with a light or a bright color is pleasurable you ask me a question that I cannot answer. I do not know that any psychologist can answer it. You are asking a question concerning the mystery of pleasure and pain.

As the child grows older if a person touches his tongue with a stick of candy you have noticed how quickly the candy occupies his consciousness. If we analyze that, we must think that it is the pleasure of taste that is the condition of his paying attention to the stick of candy.

So in these two instances it seems that the condition of attention is a feeling of pleasure, in the one case attending a visual image, and in the other case attending a tactual experience, and yet, as I said, if you should ask me why the taste of something sweet is pleasurable, while the tastes of something bitter is disargeeable I could not give an ultimate answer.

Let us follow that child. He has grown to be a boy about fourteen years old. At home his mother asks him to do an errand of some kind, or to shovel the snow from the back yard so that the clothes can be hung out. You can imagine how some boys move in such a case. Suppose that boy is asked to go down stairs and bring up a hod of coal. You have noticed that he shows the same reluctance and in-

difference. Now if you follow that boy in the afternoon out on the foot-ball field notice the difference in his way of acting. See how hard he will work, how he will endure rough handling, players will fall upon him, kick him, and bruise him, and yet he will continue this work with pertinacity of purpose. You ask the question, "Why does he do that with so much avidity whereas he did another piece of work with so much reluctance?" The answer will be—Because he likes to play foot-ball. There is something associated with the work of playing foot-ball that makes the individual pay attention to it.

I am simply dealing with the fact. I am trying to point out that there is an agreeable feeling associated with one experience and not with the other. It is not because it is easy to play foot-ball, for it is harder work than shoveling snow, but the difference is that there is a feeling of pleasure or satisfaction associated with one kind of work, and not with the other. So you see all through the experience of the individual when we have that state which we call attention you may be sure that you can find associated with the act a feeling of pleasure, satisfaction, desire, or of some other kind. In analyzing these simple instances I have tried to point out that there

must be a feeling concerned; therefore a teacher must be sure to study her case and find out what feeling may be utilized to secure certain things in education.

This is true in all phases of life. When people do things with avidity, it is generally because there is some motive associated with the doing. Remember when I say doing, I am referring to an attentive act. We may not be able to readily perceive the feeling, but this is no reason for its not being there any more than our failure to see why there is a feeling of pleasure or satisfaction associated with the hard work of the game.

You remember the story of the man who was working in a sewer, and some one said to him, "You have to work hard, my poor man, don't you?" "Yes," the workman replied, "but you ought to go over there and see those people play lawn tennis." There was a feeling of satisfaction in playing tennis, but the poor laborer did not perceive it. I remember when I was in college whenever I looked from my dormitory window at the opposite building, I used to see a man engaged in looking through a microscope. Even when we were to have some athletic game or entertainment I would find him still looking through that microscope. I could not understand how that man could

persist in paying attention to the microscope when we were so absorbed in an anticipated game on the athletic field, but it was simply because I had had no experience in that way, and did not know the fascination of looking through a microscope. There was a feeling associated with that particular act. So when we see people applying themselves assiduously to some line of work, you may be sure that the manifestation of attention is due to some motive or some feeling associated with the line of work they are following. There we have a solution of the most important phase of education, whether it be the case of a child at school or that of an adult.

Now let me call your attention to what is called "seat work." Teachers realize today better than they did formerly that when they are in the presence of children they can make them like, or want to do certain work, and therefore secure attention by personal influence; but it is important that when the teacher sends the children from her presence, even if it be only to the seat, she should provide for attention. A teacher may be concerned with the beginnings of reading. She wants a child to look at a printed sign and associate ideas with the signs. This is not attractive work, but she arranges some devices with

which there is associated certain satisfaction. She gives a child pieces of cardboard on which there are words, and some on which there are pictures, and the child puts these together; or she gives the child lines of poetry to be put together to make a stanza.

In the case of arithmetic work, in teaching the facts of addition, subtraction, and multiplication the work consists in repeating over and over again some very dry and uninteresting experiences, but if a teacher can arrange some device in the way of having figures on cards that can be put together she is making the child do something that he likes to do, and at the same time learn facts in ciphering. Children like to do this, and in this way they do work that under other circumstances would be drudgery.

I come again to what we call object teaching. In almost all cases where we can use our eyes in looking at the thing itself, there is more satisfaction than in merely hearing or reading words about it. I will not attempt to analyze why this is so, unless to say, perhaps, that it is because we get a more vivid idea in this way. So when a teacher makes an experiment illustrating the lesson, she generally has the attention of the class. She may use a picture, or something of interest like a piece of the house

where a certain literary man lived, or a piece of a ship that was engaged in a certain fight, or a segment of some rock concerned in the lesson,—just looking at something of this kind is generally attended with satisfaction. In all objective work the teacher in her instruction influences the child to have the same ideas that she has by using objects, and thereby producing the feeling necessary for attention.

In the case of silent reading the teacher makes it a part of her work to influence pupils to read certain books. The teacher does not have to do much to make children read a story, because the story in itself contains this element of interest. Here I might point out that in a story the writer has observed the law of attention in that he has recognized that change is generally a condition of interest, and therefore of attention. This is true also in physical experiences.

So the story-writer takes advantage of this condition of interest. When it is desirable to influence children to read something that in itself does not contain the element of interest for the child, then it is the business of the teacher to associate with the reading in some way a feeling of desire, pleasure, or satisfaction in getting the idea that the writer has embodied in that book,—it may be an essay, a

sketch, some kinds of poetry, or some kinds of fiction. Sometimes it is necessary for the teacher to associate with the works of Scott, Goldsmith, or Burns what the writers have done, and what feeling is associated with the imagery that they portray. The teacher should do something to make the child in reading such books, have the same feeling that the adult has. I am inclined to think that teachers often think all that is necessary is to tell a child that such a book is a standard book, that people read such books, and they think they have accomplished their purpose when they have done that.

Writers and lecturers on literature have realized that it is very important to obey this law of attention, and any teacher or lecturer who does not make us want to read certain things that we would otherwise not want to read fails to accomplish his purpose. The chief business of an instructor should be to make other people do work, that is, pay attention to work, which is worth attention.

In teaching the beginnings of number we use objects like blocks. By means of these blocks we teach the simple facts of figuring, not that we could not teach these facts without the blocks, but because the blocks are generally attention devices.

In the kindergarten we observe this law of attention. The kindergarten is an attention school. Its principal mission today is to take children at the erratic age of four or five, when it is difficult for them to pay attention to anything for a long period of time, and by means of these various devices, induce the child to pay attention to a certain thing for a period of proper length. The kindergarten trains a child to pay attention. It does this by giving him something profitable to do in a way that attracts him, because there is a satisfaction in letting out this energy through movements of the hands. By using devices that appeal to the child the kindergartener is recognizing in a very intelligent way this great law of attention.

Manual training is another instance of the application of this law of attention. I am inclined to think that manual training has been misunderstood. So far as any manual training school aims primarily to make skilled workmen, that is, emphasizing dexterity merely, I think it fails to realize its highest possibilities. The main purpose of manual training should be to associate a feeling of interest in manual work that will lead the individual to be interested in other kinds of knowledge. A boy may not be interested in mathe-

matics, or he may not like to read anything except stories. If that boy is put into a manual training school, and is influenced to make a model of an engine, and almost all boys like to make things because there is a satisfaction in using the hands, and letting out energy through the movements, then he might be induced to do something else and thereby be led to study subjects that otherwise would not interest him. He comes to a place where he wants to know how much, then he must go to the science of quantity, mathematics,—he is in a condition to be taught mathematics. He wants to know something more about the heat problem, then is the time for him to be sent to the library for a book to receive instruction. So in all manual training schools there is a chance to associate with the work large ideas of intelligence. I appreciate to the fullest extent the possibility of manual training. In this way workmen can be made to realize the possibilities of the lines of thought connected with their tools or machines, and they can be influenced to read and think in such a way that they will be intelligent and enlightened, and will get what we call the higher education.

Now there are two kinds of attention, generally spoken of by writers of psychology

as voluntary and involuntary attention. While I do not care very much for a strict nomenclature in this connection, yet I think it convenient to make this distinction. By involuntary attention is meant that in which the feeling is directly associated, and by voluntary attention is meant attention in which the feeling is remotely associated, but they are both manifestations of the same law.

As we have had it brought out in the illustration, a young child manifests that kind of attention in which the feeling is directly associated. It is the pleasure associated with the bright light that makes the baby pay attention, and it is the pleasure attending the game that makes the boy give it his attention.

The primitive man, as we study him in the light of progress in history, may be regarded as a child in this respect. The savage manifested this kind of attention. He differed from later growth in that he obeyed that law. The savage worked when he had a feeling that made him do that special piece of work. When he had a feeling of hunger, and felt the need of food, he went fishing. When his hunger was satisfied, he would stop fishing. So in all his experiences he did not look very far ahead. He fought with his neighbor for food, for shelter, and for possession of territory, in order to

satisfy his immediate desires,—simply because he was actuated by a realization of his present needs. Experience taught the primitive man that he ought to plan ahead, for though his immediate need of food might be satisfied, in days removed from the present he would have a feeling of hunger, so he would imagine that feeling, and be influenced by it to do work for another day. Just as soon as man began to anticipate the future by raising products for future needs, and by laying up for a rainy day, —just as soon as man began to anticipate events removed from the present then civilization began, and in that way civilization went on.*

You will find that the lecturer on sociology will point out to you what he calls a force, but you will find that it is feeling that has made society what it is. It is the need of food shelter, and clothing, or it may be fear, superstition, or vanity, and I fear we have not yet out-lived that any more than we have outlived other motives that have actuated people to do certain things. So you see this law that feeling must be associated with anything to which we pay attention is far reaching. It seems to me that the mistake that is often made in the care of children is failure to realize that when a child is doing wrong, he is actuated by

*Ribot

a wrong feeling. Now what should be the proper way of dealing with that child? Why, to do as we would be done by. When a person gets out of a mood that is associated with a certain act then he can easily refrain from the act. Why should we not recognize the same right on the part of the child? We should realize that it is the feeling that we must change. We must make the child feel that he would like to do something else. The old nurse was sensible in this respect. When the boy fell down and bumped his head, and would begin to cry, she would divert his attention by changing his mood so that he would forget his grievance.

We often hear about breaking the will of a child. If anything is pernicious, it is that. The will is certainly concerned with motive, and if people will take care of the motive, they will certainly provide for the will. In all instances of caring for children, whether in the family or in the school, let us be sure to realize that this is a wide law of human nature, and let us be sure to substitute a good motive for a bad one.

XII.

Voluntary Attention.

Let us consider now what is commonly called voluntary attention. That designation is generally applied to those acts which are supposed to be done by the power of the will. Whenever a person does anything that he is not interested in, and that he forces himself to do, it is spoken of as a case of voluntary attention. If we analyze these cases of voluntary attention I think we shall find that they all conform to the general law of attention that I have announced. There is feeling somewhere connected with the act. It seems satisfactory to me to say that the difference between these kinds of acts which we call voluntary and the spontaneous acts which we call involuntary depends upon the remoteness or nearness of the feeling. We shall find, if we consider school work, that there are many acts of voluntary attention among those parts of the work where we have reward or punishment of some kind. A prize, mark, or honor of any kind is generally given in cases where the subject is not made attractive or interesting enough to induce the person to pay the required attention. So you see there must be connected with the subject or the act to be done a feeling, and that feeling is pro-

vided for by some additional means. Let us consider the case of the prize. The person wants to get a prize because of the feeling of pride or any other phase of satisfaction associated with getting the prize. In order to get the prize he must get a certain record or attain to a certain rank, in order to get the rank he must answer some questions, and in order to answer the questions he must study something that is unattractive like some phases of mathematics or language. In this analysis you observe that the feeling is present, but it is remote from the act of attention, namely, study. There are all these steps between, but still it is feeling that secures the attention. That statement is true in all cases where artificial means are utilized for the purpose of securing attention. It is true of giving marks whether in the daily recitation or in an examniation. Giving marks is an attention device. It is a reward or price paid to the learner for giving his attention to what would not otherwise seem to him worth his attention. I think you can at once see the objection to such devices. In all school work as well as in all kinds of education it is highly important to have the motive just as near the subject matter as possible. It is important to make plain to the learner that the subject is worth learning for something immediately resulting from the subject itself. You

can see the reasonableness of this. Think of hiring a person to read something of Shakespeare, Virgil's Aeneid, or Homer's Iliad by offering him a prize, or the possibility of high rank, or of passing examinations. Just think of a school which has to offer for paying attention to the masterpieces of art only the motive of winning a prize, and a prize that really appeals to the person's vanity, instead of offering as a motive the appreciation that should be connected with the act.

According to this law of attention in all educational work the motive if possbile should be the result or the advantage of the educational experience. The motive should be inherent in the thing done. It is the teacher's business to secure attention by making plain the worth of the educational experience. Just so far as anything degenerates into a task, just so far will it fall short of being educational. This law makes plain one very important function of the teacher, namely, to interest the children in the work that is done in the school, and to have a good, satisfactory motive for doing that which is in the educational course. I think that progress has been made on these lines more decidedly than on any other. The best schools that have come under my observation are those where marks, honors, and rank

are dispensed with. I say that very deliberately after careful examination of schools of this state. Yet there are some people who think we cannot get pupils to pay attention to educational subjects unless we hire them to do so. It is far more important to have young people leave school loving their studies although they may not have learned as much as others, than to have them leave school hating their studies even if they have learned a great deal. Then they will have a taste for the best things, and their growth and improvement will go on.* The motive for continued attention remains, whereas in that process where the attention depends upon rank just as soon as the attainment resulting from the offer of a prize or honor has been made, then the subject may be cast aside. Therefore this subject of voluntary attention presents some aspects that are well worth a teacher's consideration.

If we look into life we shall find that in the different phases of work attention is secured by feeling, although it may be remotely connected with the work done. Take the case of the professional man. The lawyer searches books for uninteresting evidence, not because searching is interesting, but because remotely connected with that act is something he can do that is interesting, and therefore he does that disagreeable work.

*Lubbock

Here is a man who goes to the uninteresting routine of his daily occupation. He does work that is unattractive in every respect, yet he pays continued attention to that work. He must have a motive or feeling. What is it? He has a family. He must provide food and clothing for that family. The affection and satisfaction that make up what we call interest in his family are associated with providing a means for their support, money, and in order to have this he must do service. So in an indirect way there is feeling connected with that work. That is why he pays attention to it.

If we analyze those instances where people do things that are not attractive in themselves, we shall find that they do not do those things because they do not like to do them, and because they have formed a deliberate resolution to do hard things. Whether work is done for one's self, one's family, or the welfare of the community there is always the motive that has in it the element of interest. I think it is very unfortunate to advocate, as some people do, the necessity of making children do things that are disagreeable, things that are hard, and things they do not like to do, just because they don't like to do them. I often hear an educator say, "The reason why I make a child do that is because he doesn't like to do it. I want to

train children to do things that are hard." Now this is not in accordance with the law of life. People do things because they have a motive of interest, and I think that children should have the same advantage. I believe it is the business of the educator to find out what interest he can associate with something that is disagreeable or hard, and give the young person the advantage of it. It is all right to have children do difficult things, but I think they ought to have the same advantage of motive that people have in the general struggle for existence.

People often think it is strange that a boy should want to leave the farm. He does not have the same condition of interest in his work that he might have in other places. The boy goes out to work on the farm. He is given a stint to do,—mowing or some other kind of farm work. There is nothing associated in that experience that interests him. How about the farmer himself? He is interested. He has a feeling connected with the results he is going to get. If he is getting in hay he has a feeling of what this product is going to mean to him. The boy does not have this feeling. He goes to the city and if he works at some trade he has the prospect of getting up a little higher. So in all educational processes it seems to me

that we must recognize this great law of nature, that in order to have attention we must have some feeling either directly or indirectly connected with the act of attention. If I should take up some other illustrations in which it seems that people are dong something even more uninteresting than I have mentioned I think you would still find some feeling remotely connected with the act.

Higher Intellectual Operations.

Now I shall pass to some of the mental acts that I designate as higher intellectual operations, higher than mere observation and image getting, higher than merely repeating former experiences, for those are the mental processes that we have thus far been concerned with. I would mention classification, reason, generalization, and abstraction as some of the terms applied to the mental acts that I have not thus far dealt with at length. We have been concerned with the process of getting ideas, and with the process of memory in repeating those ideas in one way or another, in the way we call memory, habit, or automatic revival. Now it is my purpose to try to present to you a very simple aspect of these higher intellectual operations. I think there is one aspect of that phase that is very definite and clear, and if you can appreciate this aspect of mental action I

think you have something by which you can test all of these operations. Let me state this truth. The human mind has the power of discerning difference or recognizing likeness. These statements mean the same thing, because of course if an individual can discern difference, then he has the power of recognizing sameness. When I say that the human mind can perform this act I do not attribute to it anything more marvelous than when I say the mind can form images, and can repeat former acts. We do not attempt to tell why a person has a mental image, or why the mind can repeat, neither do we pretend to say, when we make that statement, why the mind can discern difference. This is a fundamental act of consciousness. This power is the essence of each one of the intellectual operations. Let me proceed with illustrations to see if I can demonstrate that. Let us first consider classification. Classification is commonly spoken of as a process of putting things together. The mind puts together ideas that resemble one another. I think among the subjects of science perhaps we can find the best illustrations of the act of the mind in classifying, although in all its experiences the mind is classifying. As I stood before a cage of eagles the other day at Central Park in New York I was reminded of classifica-

tion in connection with birds. The eagle belongs to an order of birds which includes the owl and the hawk, and I might say the falcon and vulture which are not so well-known to us as the others. The human mind has classified them into one group because they are alike in some respects. They all have a strong, upright body, curved beak, and strong, sharp claws. If we look at different eagles, different owls, and different hawks, we shall find that they are all the same in those respects. So classification consists in this instance of recognizing likeness, forming a group, and thinking of all these birds as a class, ignoring their differences, and avoiding many details that might be confusing.

In common life we do the same thing. Very early in life a child begins to classify by recognizing likeness. He puts the parts of the furniture into groups. Different as chairs are, he puts them together in one group; he does the same with tables. He classifies common animals, like the dog, the cat, and the horse. They differ largely, but there are features of sameness which he recognizes, then he makes a group, and he thinks by the help of the group. This is the meaning of classification.

I hope this will suggest to you what we mean when we say that classification of the higher

kind is this act of recognizing that individuals have certain features that are the same. This is one part of knowing. I have emphasized the other part of knowing, the part the senses play in getting material, and forming images, but there is more to it than that. Let me illustrate with a very common example. A person meets you on the street. The person says, "Don't you know me?" What does that person mean? He doesn't mean,—"don't you form a mental image?" because if your eyes are open, and if you are not blind, you cannot help but form a mental image. He means don't you remember this image, don't you recall another image, and don't you recognize that this is the same as the other?

A child brings to school a natural history object, it may be an insect or a mineral, and he asks the teacher what it is. If she says it is an insect, she recognizes that it is the same class as other insects she has known. If she says it is a beetle, she is doing the additional act of recognizing that it is the same as another specimen that she can remember. If she says, "I know that mineral, it is a piece of quartz," she is recognizing that it is the same as another mineral the image of which she can faintly revive. So in all processes of knowing we must form an image, remember that we

have previously formed another image, and recognize that the particular subject in hand is the same as that with which we have had former experience.

This is a very simple phase underlying many things that I think psychologists make very elaborate. I think it is the essential of what they call apperception. The phase of mind action in apperception involves this same power of recognizing likeness.

I have just time to take up one illustration of reasoning, so that you may have this to think of, as I apprehend that you will want to think of these applications in order to really appreciate the fullness of their significance, otherwise you may fail to realize how far-reaching they are. I think in any process of reasoning the essence of the mental act is recognizing likeness. When a person reasons, he recognizes likeness. This sounds simple, and yet we often think of reasoning as a very intricate and hard process. Now I am going to use for an illustration one of the best instances of reasoning on record. I want to consider with you the mental process that Benjamin Franklin went through when by reasoning he found out this idea, namely, that the cause of lightning is electricity. That was one of the greatest and most remarkable generalizations that any one

of our countrymen ever made. He found this out, not by observation and memory alone, but by this mental act which we call reasoning.

Franklin had experimented at length with electrical apparatus. He had by the use of his electrical machine found out a great deal by observation. I will refer to one piece of apparatus which he used. I have here in my hand a square piece of glass. On each side of the glass there is a piece of sheet lead. This is only one of many experiments that Franklin made. He charged one piece of metal with electricity that he got from a frictional machine, then he charged the other piece with electricity that he got by induction from the earth, so that one piece is charged with one kind of electricity, and the other with another kind. Then he connected these two pieces of metal and he saw a bright spark, and heard a snapping sound. So he learned by observation that when two pieces of matter charged with opposite kinds of electricity are brought near each other light and sound are produced. He had observed the lightning and the thunder, and had realized that here was a manifestation of light and sound similar to that in his various experiments. In the case of the lightning there were two masses of matter, two clouds. The summary of his observations was that in all

respects the manifestations were the same. It is electricity that produces the light and sound in the case of the glass and other phenomena that he observed, therefore he reasoned that the same was true of the thunder and lightning, namely, that they were produced by electricity. He gained every idea from the cloud manifestation just as he had with his apparatus excepting the truth that the lightning and the thunder were produced by electricity. He gained this by reasoning, the essence of which was recognizing saméness. Then in the interesting kite experience he verified that process. He went out into the fields, sent a kite up into the clouds, and brought the electricity down, and in this way verified his process of reasoning.

XIII.

MATHEMATICAL REASONING.

Let us continue the analysis of reasoning by taking an example from mathmeatics. Our purpose will be to show that in mathematical reasoning the process consists essentially in recognizing likeness among certain ideas. It is a peculiarity of mathematical thought that the thinker must start with certain truths, as axioms, some definitions, and some demands that are called postulates. In all reasoning we must have our facts to start with,—we must have some knowledge. With that preliminary, let me go through this process.

I will use the well-known proposition that when two straight lines intersect each other, the opposite and vertical angles are equal. In the demonstration you remember that the sum of two adjacent angles are equal to the sum of two right angles; then it is pointed out that the sum of two other adjacent angles is equal to the same. It is obvious that we have in this statement the same truth as that involved in the axiom which states that things equal to the same thing are equal to one another. Therefore these groups of adjacent angles are equal to each other. Again these groups contain one

angle common to both, and the statement is made that one and the same angle can be taken from both. Here we have the same truth as that in the axiom—if equals be taken from equals, the remainders are equal—therefore the remaining angles of the group, which are vertical angles, are equal. In this process of reasoning it is obvious that each step involves recognizing sameness. If you should follow all geometrical reasoning you would find that this is a fair representative of all cases of mathematical reasoning.

I want to call your attention to the fact that the knowledge we use in this is a little different from the knowledge we used in the illustration of the last lecture, or from any example of physical science. I wish I had time to dwell a little longer upon the history of psychology on such ideas as these—ideas of axioms, general ideas of mathematics, ideas of space, time, and ideas of cause and effect that psychologists have contested. They have asked,—Where did the individual get these ideas? Some say he is endowed with them from birth, that they are intuitional, and some say he has gained these ideas from experience. The evolutionist modifies this. The evolutionist says there is a grain of truth in both schools,—that all ideas are attained by the individual by his response to his

environment, but these general ideas have been attained through eons of time by the race, and it has handed down to posterity what it has gained. So the individual does come into the world endowed with some physical conditions for knowing these ideas.

Reasoning is a classification in the sense that it groups according to likeness, but what it groups makes it a little different from classification as we commonly think of that process. Common classification mainly deals with recognizing likeness among things, whereas reason deals with relations. As there are different kinds of thinking, and different kinds of memory, so there are different kinds of reasoning according to the relations we are dealing with in this process of recognizing likeness. In his experiment Franklin dealt with the relation of cause and effect in his reasoning. In mathematics you observe that the relations that we are dealing with, are the relations of equality. This is true of all mathmatical thought,—sameness in quantity of space or time, and sameness in quantity means equality. If a geometrical figure occupies the same space as another, then we say they are equal to each other, because they are the same in that respect. In arithmetic the facts that the teacher deals with are facts of equality. Two and three, just the same as

five, that is equals five; seven minus four, just the same as three, that is the remainder equals three. The multiplication table is a series of facts concerned with equality in connection with number. Two threes just the same as, that is, equal, six, two fours just the same as eight. In algebra the most conspicuous fact we can think of is the fact involved in the equation. It is the most useful thing in that branch of mathematics. The equation is an expression of equality. So the relation in mathematics is a relation of equality; whereas in science, in history, in sociology, in the studies pertaining to humanity, we are concerned with another kind of relation, namely, that between cause and effect.

We hear a great deal about mental training. People think they have said enough when they give the general statement,—It is good mental training. It depends entirely upon the kind of training needed. Let us take an illustration from a physical experience. Supposing a person is trying to learn to play the piano. She finds that she must use her fingers very flexibly. Suppose a person should say, "Come over to the gymnasium and run around. It is good training. It will help you play the piano." Just because running is good physical training, that does not close the argument that it will

make the fingers flexible, and therefore contribute to the end that the person desires. If a person is studying geometry does it follow that he is going to gain facility in reasoning about cause and effect? Supposing a person has drilled in repeating the forms of language, does it follow that such practice is going to conduce in the most effective way to his ability to reason about the welfare of humanity, of the community or of the state? I hope you see that it is necessary for a person engaged in educational work to have a clear, definite idea about these higher intellectual processes, and the statement about mental training does not carry conviction with it until we have tested it by analysis. So we should train the mental processes that will be most useful. Just a word further about reasoning. I think from my analysis it must be obvious to you that reasoning must deal with facts, that in order to reason a person must have a good stock of data and of evidence, that is, of knowledge that is of the most worth. So a child in the common school would better not be called upon to reason much until late in the course, because he is then furnished with mental material more advantageously. That is why the wisest educators have advised that a child would better not be called upon to do very much reasoning until

he is thirteen or fourteen years old. The early part of his course would better be concerned with other kinds of mental processes, namely, those I have dealt with in the early part of this course of lectures,—with knowledge getting that will be useful. How are we going to find out what will be of the most worth? By studying life, and by studying what will count the most in life.

Classification is valuable in common school education. In our science lessons a child sees an experiment in which when heat is put into water it is changed to a vapor, and when heat is taken out, the vapor becomes a cloud or a drop of rain. This is knowledge getting. The teacher points out that the same thing happens in cloud, in rain, in snow, in dew, and in fog. The teacher makes the child see that the truth here manifested, is the same as the truth in these larger processes. This is classification. The truth you have learned about the candle flame is the same as that in any stove, or in every case of fire whether in the burning of a match or the conflagration of a city. A child learns by observation that when certain substances are rubbed a kind of force which will produce motion, and which we call electricity, is produced. He identifies that with every instance of frictional electric-

ity. The teacher shows that when a current of electricity is sent around a nail it makes a magnet of the nail. This truth is the same as that of the electric telegraph, the electric bell, the trolley car, and many other applications. This is simply grouping these various cases that are the same in certain respects. Teachers should realize therefore what an important part in school work classification forms. This power to identify many manifestations of the truth which we have already acquired is one meaning of culture. Knowledge getting, and this process of classifying our knowledge are two of the important parts of our education that should be attended to before the child is thirteen or fourteen years old. Then the reasoning process can be carried on far more advantageously, for the child will have more resources to help him at that time.

Another intellectual operation in which this power of recognizing sameness is involved is that which we call explanation. Suppose a person explains a thermometer; what does that explanation consist in? He points out that the column of liquid mercury, when heated, rises. The pupil has seen in a simple experiment that when heat is put into a column of water it causes the water to expand, that is, it rises. He sees that the same is true here. The teacher

points out in her explanation that as it is heat that causes the water to expand and rise, so it is heat that causes the mercury to rise, and the pupil observes that both cases are the same.

In explaining the structure of a piece of sandstone the teacher points out that a gutter stream may bring down and deposite sand, that if we have pressure these particles of sand may be compressed, that is, stuck together, and if they are heated we know they cohere, as in the case of heating bricks and earthen ware. She points out that in the past sand was probably deposited by water, was compressed, and was heated, and we have as a result this product,—a piece of sandstone. In this way she has pointed out that the same thing that is happening in the present, happened in the past, and in this way the sandstone was formed.

I remember a friend of mine telling me that he entertained Professor Agassiz when he came to this country. One of Agassiz's earliest experiences in this country was giving a lecture in his town. He was always a very accessible man, and always ready to explain things. He was famous for determining the kind of fish by looking at the scales of the fish. One morning a milkman said he wanted to speak to the Professor. Agassiz went out, and the milkman took from a piece of paper some fish scales, and

asked the professor if he could tell to what fish they belonged. Agassiz looked at the scales, and, to the milkman's astonishment, said. "They are the scales of a common sucker." He did this by the process of recognizing sameness. That had been his specialty. He had had experience with a great variety of fishes, and those scales were the same as those he had seen many times.

I want to speak now of what is dealt with in psychology as a concept. Suppose we form images of trees. We can revive an image of an elm tree, of an oak tree, of a pine tree, or a poplar tree. Now suppose I leave off the adjective, and tell you to know tree. If you can do this you form a concept. That which is involved is the sense of sameness without any of the differences. You must not image a pine tree, an oak tree, or a poplar tree, for the concept must involve only that which is common to all. You can do this by this power of the brain to recognize sameness. When the brain attempts to produce an idea of trees without any of the individualism of any particular tree it tends first perhaps to produce an image of an elm, but this receives a check by the pine tree, and this image in turn is checked by the poplar, and so on. The result of this is the concept. I do not care very much

for that psychical product. If an individual forms a concept of a tree, it is because he has had much experience in forming images of different kinds of trees. If we take care of the separate images, whatever is necessary to form a general idea, that psychologists call a concept, will be provided for; therefore it is the business of the teacher to give ample provision for the individual images.

By the word abstraction we mean taking away, or abstracting. It implies the power of discerning that which is the same in many cases, and dealing with those phases of sameness. The idea of blueness is that idea which is taken from a variety of sources, and is contributed in every case. We recognize it as the same, and therefore we abstract it. Whether it is the blue gentian, the blue water, or the blue sky, whatever may be the substance to which it belongs as an attribute the different forms are the same in the respect that they all possess the attribute blueness. Abstraction consists, you see, in dealing with one part of the image and ignoring the other parts. Thus the abstraction of hardness consists in taking one property of quartz, steel, or wood, and recognizing that these different entities are the same in one respect, namely, they all have the power of resistance. That which I am now

emphasizing is that in this power of abstraction we are still recognizing sameness, and abstraction depends upon this.

Let us consider an attribute of a human being like goodness or quickness. Our idea of goodness has been derived from dealing with human individuals, and gaining a knowledge of one part of their action which we call good, and so far as individuals are the same in that attribute of character, so far do they furnish us the attribute of goodness, which we consider separate from other characteristics.

I have reviewed some of these processes for the purpose of presenting to you a simple way of regarding them. I believe it is a useful way because I have tested it a great many times. The point is this, that the teacher must have a very clear, simple, and therefore, useful way of looking at the processes by which the human mind acts.

XIV.

IMAGES AND FEELINGS.

There is a story told of Sir Walter Scott in which Scott says he once saw the poet, Burns, at the house of a friend in the city of Edinburgh. Burns was looking at a picture of a poor soldier lying dead on the battle-field. On one side was a dog resting his head on the soldier's body, and on the other side was the soldier's poor wife with an infant in her arms. Scott says that Burns was very much affected by the picture, so much so that he even shed tears. I might say here that Scott was only about fifteen years old at the time, and was proud of the fact that he could tell Burns who wrote the lines of poetry under the picture.

I have given this illustration for the purpose of bringing before you this fact, namely, that one of the effects of imagery is emotional, that is, we have feelings associated with the images. Images, feeling, and the idea of association between them, is what I want especially to deal with, and my purpose today is to direct your attention especially to the feeling part of the suggestion.

The word "feeling" may be applied to a large variety of psychical states, including the

sensations which we have already dealt with as a part of knowledge. It may be applied to the intellectual phases as well as to the emotions, which may be regarded as different from the intellectual element of psychical experiences. Mr. Herbert Spencer divides feelings into the peripherally or externally initiated feelings, mainly the sensations, and the internally initiated feelings, or the emotions. I shall use the word, feelings, in this lecture, to express those internally initiated experiences which we ordinarily call emotions. It seems to me that this is one of the simplest divisions we can use. In the case of this illustration you observe that the emotions were directly aroused on the part of Burns by these mental pictures that he realized. They were the internal agents that excited the feelings which we call emotions, and which vary from the simplest that we might call pleasure or pain, to the complex that make up the highest character.

The special point of view that I want to take is that of the teacher. What is the teacher's interest in emotions? What ought she especially to know about them? In the first place it may be well to note that emotions constitute in the main this something which we call character. There are different kinds of

character according to the prevailing emotions that constitute the variety. As character should be the highest object of the teacher in her work this emotional element ought certainly to receive her attention, as to what it means, and how it can be produced. I want to be sure to emphasize this idea of association implying that emotions depend upon knowledge, upon mental pictures. All artists recognize this. It is the ultimate purpose of the artist to affect the emotional nature of the one for whom he works. Whether that artist be a maker of pictures, a composer of music, an orator, or a writer of books, his highest purpose is to affect feeling, and he does this by the agent which I have called imagery. We had this brought out at the beginning of the lecture. This typifies the purpose of all picture making.

The composer of music has dealt with sound images that are associated, with feelings whether these images are grouped simultaneously in harmony, or in succession in melody. The orator by all his ways and means generally works upon the feelings, especially when he depicts the illustrations in an argument. The writers of books aim at the same thing, namely, causing the reader to have certain mental pictures, and by this means producing the far higher effect of arousing the sensibilities,

bringing out the best there is in the world, doing what we call inspiring, so that the mental nature is aroused.

I want to say this morning in a very pronounced way that this is the most imporant part of education. I say this especially because I have devoted so much time to other parts, particularly to knowledge getting, but knowledge getting in itself is not the most valuable feature in a person's growth. I have dealt with certain activities which are machine-like in which we do away with conscious action as much as possible, and I feared that you would go away thinking that these were the most important parts of education. The psychical truths of memory, habit, and reflex action are important as they refer to indispensable work that we must do, but beyond all this is the work of affecting the emotions, the material that makes up the very highest thing in the world, namely, human character.

The teacher is concerned with the feelings in that she is concerned with affecting the nature of the individual. So far as we are concerned with feeling we aim at changing, or affecting the mood. If we can only put a person in a proper attitude, so far as his feelings are concerned, to life, and to human beings, this is the highest thing we can do. People are often

puzzled with life because they are concerned with the objective side, they are dealing with the outside. They make the mistake of thinking it is necessary to change outward, material things. The great lesson we have to learn in this connection is that the individual must be adapted to the possibilities of the environment, and this is a work the public schools may accomplish.

Again the feelings not only constitute the nature of the individual by which he is adapted to his environment, but they are the motive power of the individual. Whatever is done is done largely because of the soul, devotion, enthusiasm, or spirit of some kind in the individual. Therefore if we wish to help people to higher and better living, that part of their activity we must be concerned with especially is the feeling. This old saying comes into my mind: Knowledge is power. I think more of that now than I used to, because I am interpreting it in this way. If we enable the individual to get knowledge that is of the most worth, the kind of knowledge that produces the highest motives and the best feelings, just so far as these ideas that we call knowledge are fraught with the noblest emotions, just so far is the possession of such knowledge valuable to the individual. The teacher should in-

terpret knowledge in this way, because this will make her ambitious to study and pick out that knowledge that will be of the most worth.

De Quincy, in one of his essays, gave utterance to these words: "There is a literature of knowledge, and a literature of power." This has been quoted a great many times. If De Quincy meant to make a decided distinction between these two ideas of literature it seems to me that he may be misleading. Perhaps it is better to say that the power resulting from some kinds of knowledge is greater and possibly more uplifting than that resulting from other kinds. In all cases of power we should probably find by analysis what may be regarded as knowledge, but of course we must be sure to realize that even a product of the imagination may be classified as knowledge, as it includes the image which we have regarded as the unit of knowledge. De Quincy refers to Milton as having produced this power by imagery. It was by that unit of knowledge, the image, that he obtained his results.

Now in dealing with feeling a teacher must rely upon two ways. In the first place she can affect the emotional nature, that is, the character of her pupils by her personality. Before I proceed to that let me tell you something that I have almost forgotten. I was once talk-

ing to a champion oarsman, a man who had never lost a race, and yet if you had looked at his physique, you would not have thought this likely. He was concerned with training young men in college. He told me that he put very much more dependence upon the character of the young man than people would think. He said it was the spirit, the self-sacrificing element, and especially the honesty of the individual that he counted upon most. I could realize that, for I had known that man from a boy, and he was ever noted for his honesty of purpose and reliability, I could feel that whenever he was in a contest he devoted himself wholly to the work at hand, and that counted a great deal. So the teacher must realize that her honesty of purpose, her devotion, her interest in the subject, and her spirit of helpfulness will have their results in her work. I think nothing can take the place of the individual. Powerful as the printed page may be, it never can take the place of the possibility of the living person who is really in earnest, and has the feeling element in her make-up.

Why was Robert Burns been so influential as a writer? He was unlettered, he did not have a liberal education, he did not have the advantages of a University course, yet he lives in the minds and affections of the whole world,

and though literature itself may change, still Robert Burns is appreciated and loved by those who appreciate poetry. The reason is this, as Carlyle says,—Burns was sincere. He was sincere in his feelings. In his experience there were no superficial sentimentalities. He dealt with lowly life and with nature with so much sincere feeling that he influenced the whole world by his poetry.

If you contemplate any great piece of oratory like the speech of Abraham Lincoln at Gettysburg, or Patrick Henry before the Virginia Assembly or the speech of Wendell Philips in Fanuiel Hall when he was only about twenty-four years old, you will find that it was the temperament of the orator that affected the people.

Now I want to speak of the possible use of books. This is my last point, and it is one I want to make plain and enforce if possible. I think that the teacher must realize that affecting the character is the highest possibility of reading in the school. When we say that reading is most important we are thinking of this. If we can only teach the child to read we may change his feelings, and we may so guide him in that part of his nature as to determine his character. I do not know of any instrument that is more potent than the book, because the

book is the embodiment of the noblest souls that ever lived. Writers have left a record of their ideas, and their feelings, and we have the very best ideas to use in affecting the character of the individual we are dealing with. This has been the purpose of all writers. If we consider the Greek literature, beginning with Homer and coming down through the different periods we find that books are full of imagery associated with feelings. We find that they portrayed human beings like ourselves, and their relations to the home and to the community. If we recognize that they associated ideas with feelings then we know how we should use this literature.

This is also true of Hebrew literature. One of the most striking things is that the psalmists have used images and have associated with them feelings. Take any psalm,—"The Lord is my shepherd, I shall not want. He maketh me to lie down in green pastures, he leadeth me besides the still waters." How is the effect in that psalm produced? By the way in which the poet has used images for the purpose of affecting the emotions.

The sagacity of the Great Teacher of Nazareth in this respect is very striking. All through his teachings he used imagery for arousing feeling. I have counted ten instances

in which he used the imagination for producing the right attitude in regard to the Kingdom of Heaven. When he was confronted by the lawyer with the question, "Who is my neighbor?" he was not led into the difficulties of defining and analyzing. But he immediately proceeded to picture a man among thieves, robbed, abused and wounded, left by the wayside, two persons indifferently passing by, the third helping in every humane way possible. Then the Teacher asks, "Who was the neighbor?" And then the prompt answer, "He that showed mercy" was evidence that the imagery had accomplished its purpose not only in conviction of intellect but in terms of feeling.

Macaulay in his essay on Milton says that philosophers may deal with abstractions, but the people need images. It is striking to see how this truth of humanity has been adhered to. The highest lessons of the human race have been learned in this way.

Before I close I want to call your attention to the fact that our highest ideals have been the result of growth. It seems to me that the very highest feelings have been produced in the latter part of human evolution, although when I say the latter part we must go back and include the high ideals of many hundreds of years. There is that writer who said, "Charity

suffereth long, and is kind.'' I cannot think of anything higher than that. It seems to me this is the culmination of the possibility of human character. It is wonderful to see how the early writers caught the secret of these highest possibilities. The teacher ought to recognize the fact that we have grown in our ideals, and that the modern writers differ in these respects from the writers of Greece. Therefore we find in modern literature something that can be adapted to modern education.

I will give one illustration to bring out what I mean when I say we have today ideals that are the highest in human history. I will introduce my illustration by saying that the writer pictures a small boy as having been left on the coast of England in the midst of a raging snow storm. The men who had brought him there pushed off from the shore in their boat, and left him alone. He clambered up a cliff, found his way over a deserted country, and at length came to a forest. He heard a cry, and he approached in the direction whence the sound came. The following is the selection I will use as an illustration:

*''Let us explain at once. On the plains over which the deserted boy was passing in his turn, a beggar woman nursing her infant and

*Hugo

searching for a refuge had lost her way a few hours before. Benumbed with cold she had sunk under the tempest, and could not rise again. The falling snow had covered her. So long as she was able she had clasped her little girl to her bosom, and thus died.

The deserted child had heard the cry of the dying child. He disinterred it. He took it in his arms. When she felt herself in his arms she ceased crying. The faces of the two children touched each other, and the purple lips of the infant sought the cheek of the boy as it had been a breast. The little girl had nearly reached the moment when the congealed blood stops the action of the heart. Her mother had touched her with the chill of her own death; a corpse communicates death; its numbness is infectious. Her feet, hands, arms, knees, seemed paralyzed by cold. The boy felt the terrible chill. He had on him a garment dry and warm,—his pilot jacket. He placed the infant on the breast of the corpse, took off his jacket, wrapped the infant in it, took it up again in his arms, and now, almost naked, under the blast of the north wind which covered him with eddies of snow-flakes, carrying the infant, he pursued his journey.

The little one having succeeded in finding the boy's cheek, again applied her lips to it,

and, soothed by the warmth, she slept. First kiss of those two souls in the darkness.

The mother lay there, her back to the snow, her face to the night; but perhaps at the moment when the little boy stripped himself to clothe the little girl, the mother saw him from the depths of infinity."

The purpose of the writer is to make us see these images that are associated with ideal feeling, and we are made better for having had this emotion. The artist has produced this emotion in such an inimitable way by means of imagery. He has tried to make plain to us the possibility of human action. He tries to have us imagine how it is possible for one human being, as small as that little boy is represented to be, to act toward another, and the responding effect we have, as we read, is our glimpse of possible goodness in the human race. This is the end and possibility of any good book, and the greatest opportunity of the teacher is that presented in making the individual have just such experiences as this, producing a feeling that will overcome evil with good.